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COST ANALYSIS OF WATER POLLUTION CONTROL: AN ANNOTATED BIBLIOGRAPHY

Dennis P. Tihansky

Environmental Protection Agency
Washington, D. C.

April 1973

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This annotated bibliography is a compilation of the literature on water pollution control costs. It contains nearly 2,000 selected publications, unpublished papers, and theses focusing on the time period from 1960 to 1972, although earlier material is added if it seems particularly relevant. The references are chosen to satisfy the needs and interests of several types of researchers. For the economist, there are books and articles on economic theory and incentive systems in water quality management. For the engineer, there is information on unit treatment processes and cost implications of their design and operation. For the operations research analyst, optimization techniques, mathematical modeling, and statistical methods are referenced as they apply to wastewater control. For the policy maker, cost function literature identifies the primary determinants of cost and their quantitative effects. Political and socio-economic issues are also related to water pollution control. (EPA)

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ABSTRACT

This bibliography is a compilation of the literature on water pollution control costs. It contains nearly 2,000 publications, unpublished papers, and theses focusing on the time period from 1960 to 1972, although earlier material is added if it seems particularly relevant. The references are chosen to satisfy the needs and interests of several types of researchers. For the economist, there are books and articles on economic theory and incentive systems in water quality management. For the engineer, there is information on unit treatment processes and cost implications of their design and operation. For the operations research analyst, optimization techniques, mathematical modeling, and statistical methods are referenced as they apply to wastewater control. For the policy maker, cost function literature identifies the primary determinants of cost and their quantitative effects. Political and socio-economic issues are also related to water pollution control.

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INTRODUCTION

Comprehensive programs for reducing, preventing, or eliminating the pollution of natural water bodies and ground waters should include an evaluation of the costs of regulation and alternative solutions. The economic feasibility of such programs should be demonstrated before they are initiated, continued, or expanded. To attain national goals of water quality enhancement in the coming years, Federal Water Pollution Control Act Amendments of 1972 recognize the need for cost analyses.

This bibliography is designed to aid researchers in retrieving information on the costs of water pollution control strategies. All references are identified by a sequential numbering system. Each bibliographic entry includes a title and a publisher or journal name. If not written anonymously, it also has an author section. Finally, an abstract is appended if available from published sources. Some abstracts are modified to emphasize cost information. At the end of many abstracts is a code in parentheses. This code indicates a secondary source distribution of the entry. For example, a code beginning with 'EI' pertains to Engineering Index abstracts; 'W' to Selected Water Resources Abstracts; and 'GPO' to U.S. Government Printing Office publications. Other beginning letters pertain to purchase order numbers from the National Technical Information Service, Springfield, Virginia.

This bibliography contains almost 2,000 references. Originally, it contained more than 4,000, but most of these were eliminated for several reasons. Sometimes the same article was published under different names. Frequently similar versions of a research topic were published. To avoid duplication, either the best known or the most comprehensive report was selected. In some cases, reference were discarded because their titles were misleading or they did not contain relevant cost information.

Following the Reference List is a Subject Index Guide. Key words pertain to the main concepts of cost analysis. Below each key word are listed bibliographic entries and their identification numbers.

The following sources of information provided most of the references and abstracts:

1. A Bibliography of Periodical Articles Concerning the Management and Economics of Water Resources, L.G. Brander and B.M. Graham, Acadia University, Wolfville, Nova Scotia, 1971.

2. American Book Publishing Record, R.R. Bowker Co., New York, N.Y.

3. Applied Science & Technology Index, The H.W. Wilson Co., New York, N.Y.

4. Bibliography of Water Resources Research, National Advisory Committee on Water Resources Research, Environment Canada, Ottawa, Canada, 1972.

5. Bibliography on Socio-Economic Aspects of Water Resources, H.R. Hamilton, et al, Battelle Memorial Institute, Columbus, Ohio, 1966.

6. Books in Print, R.R. Bowker Co., New York, N.Y.

7. Business Periodicals Index, The H.W. Wilson Co., New York, N.Y.

8. Cumulative Book Index, The H.W. Wilson Co., New York, N.Y.

9. Dissertation Abstracts (International), University Microfilms, Ann Arbor, Mich.

10. Environment: A Draft Bibliography of Social Science Literature, D.E. Morrison, et al, Agricultural Experiment Station, Michigan State University, East Lansing, Mich., 1972.

11. Environment Information Access, Environment Information Center, Inc., New York, N.Y.

12. Environment Reporter, The Bureau of National Affairs, Inc., Washington, D.C.

13. Government Reports Index, National Technical Information Service, U.S. Department of Commerce, Springfield, Va.

14. Hydata, American Water Resources Association, Urbana, Ill.

15. Instances, If Any, Where Cost/Benefit Analysis Has Been Applied to Environmental Problems--United States, Organization for Economic Cooperation and Development, Paris, France, 1972.

16. Library of Congress, Card Catalogue, Washington, D.C.

17. National Technical Information Service, Literature Search, U.S. Department of Commerce, Springfield, Va.

18. Oceanic Index, Pollution Abstracts, Inc., La Jolla, Calif.

19. Pollution Abstracts, Pollution Abstracts, Inc., La Jolla, Calif.

20. Selected Rand Abstracts, The Rand Corporation, Santa Monica, Calif.

21. Selected Water Resources Abstracts, Water Resources Scientific Information Center, U.S. Department of the Interior, Washington, D.C.

22. Smithsonian Science Information Exchange, Inc., Literature Search, Washington, D.C.

23. Subject Guide to Forthcoming Books, R.R. Bowker Co., New York, N.Y.

24. The Engineering Index, Engineering Index, Inc., New York, N.Y.

25. U.S. Department of the Interior Library, Card Catalogue, Washington, D.C.

26. Water Pollution Abstracts, Her Majesty's Stationery Office, London, England.

27. Water Quality Library, Card Catalogue, U.S. Environmental Protection Agency, Washington, D.C.

28. Water Resources Scientific Information Center, Literature Search, U.S. Department of the Interior, Washington, D.C.

REFERENCE LIST

00001. THE OPTIMAL ALLOCATION OF STREAM DISSOLVED OXYGEN.

LIEBMAN, J.C.; LYNN, W.R.
WATER RESOURCES RESEARCH, 2(3), 581-591, 1966.

A DYNAMIC PROGRAMMING MODEL THAT MINIMIZES THE COST OF PROVIDING WASTE TREATMENT TO MEET SPECIFIED DISSOLVED OXYGEN CONCENTRATION STANDARDS IN A STREAM IS DEVELOPED. THE MODEL IS SOLVED FOR A SIMPLIFIED EXAMPLE BASED ON DATA FROM THE WILLAMETTE RIVER. IMPLICATIONS OF THE MODEL ON POLICY FORMULATION ARE DISCUSSED. (W69-02530).

00002. ASYMMETRY BETWEEN BRIBES AND CHARGES.

KAMIEN, M.I.; SCHWARTZ, N.L.; DOLBEAR, F.T.
WATER RESOURCES RESEARCH 2(1), 147-157, 1966.

A CLASSIC AND INCREASINGLY IMPORTANT EXAMPLE OF THE TECHNOLOGICAL EXTERNALITIES PROBLEM IS THAT OF A FIRM DISCHARGING WASTE INTO A STREAM, THEREBY INFLICTING DAMAGES ON DOWNSTREAM USERS OF THE WATER. AS LONG AS THERE IS NO ECONOMIC OR LEGAL INCENTIVE TO DO OTHERWISE, THE FIRM WILL IGNORE THE EFFECTS OF THIS ACTION ON OTHERS. IT HAS BEEN ARGUED THAT, ASYMMETRIES IN INCOME DISTRIBUTION AND ADMINISTRATION ASIDE, THE LEVYING OF A CHARGE AND THE PAYMENT OF A BRIBE ARE SYMMETRIC MEANS OF INTERNALIZING TO THE FIRM THE EXTERNALITY RESULTING FROM ITS DISCHARGE OF WASTE INTO THE STREAM. IT IS SHOWN THAT THIS SYMMETRY BETWEEN BRIBES AND CHARGES DOES NOT HOLD WHEN THE COST AND REVENUE FUNCTIONS ARE SUBJECT TO CHANGE, UNLESS THESE FUNCTIONS ARE KNOWN BY THE AFFECTED PARTIES. FURTHERMORE, A BRIBE WILL NOT ONLY CAUSE THE FIRM TO PRODUCE AT LEAST AS MUCH WASTE MATTER AS UNDER A CHARGE ALTERNATIVE OF THE SAME COST BUT MAY EVEN INDUCE THE FIRM TO PRODUCE MORE WASTE MATTER THAN IN THE ABSENCE OF A BRIBE. THE ANALYSIS DEALS WITH WATER POLLUTION FOR THE SAKE OF EXPOSITION, THE ANALYSIS CAN BE EXTENDED READILY TO OTHER SITUATIONS GIVING RISE TO EXTERNALITIES. (W69-02564).

00003. AN ECONOMIC APPROACH TO WATER QUALITY CONTROL.

KERRI, K.D.
J WATER POLLUTION CONTROL FED., 38(12), 1833-1897, 1966.

AN ANALYTICAL MODEL WAS DEVELOPED WHICH DETERMINED THE DEGREE OF TREATMENT REQUIRED BY EACH WASTE DISCHARGER ALONG THE WILLAMETTE RIVER SYSTEM IN OREGON, IN ORDER TO MEET EFFLUENT OR SYSTEM STANDARDS. A DO COST MATRIX CONTAINED THE AMOUNT OF OXYGEN-COMSUMING WASTES PASSING THROUGH A CRITICAL REACH FROM EACH WATER DISCHARGER, THE AMOUNT OF WASTE REMOVED BY DIFFERENT DEGREES OF TREATMENT, AND THE COST OF EACH DEGREE OF TREATMENT FOR EACH DISCHARGER. THE DECISION VARIABLE WAS THE PERCENT OF WASTE REMOVED AT EACH POINT OF DISCHARGE. THE MINIMUM COST SOLUTION WAS OBTAINED FROM THE MATRIX BY NONLINEAR PROGRAMMING TECHNIQUES, AND THIS SOLUTION WAS INSERTED IN THE STREETER-PHELPS OXYGEN SAG EQUATION TO OBTAIN THE DO PROFILE FOR THE RIVER. SEVERAL EXAMPLES FOR VARIOUS EFFLUENT AND STREAM STANDARDS WERE COMPUTED AND GIVEN. IT WAS FOUND THAT COST OF MAINTAINING EFFLUENT STANDARDS WAS MUCH HIGHER THAN THE COST OF MAINTAINING VARIOUS STREAM STANDARDS. THE MODEL MADE POSSIBLE THE ECONOMIC COMPARISON OF ALTERNATIVE MANAGEMENT POLICIES, AND MIGHT JUSTIFY LARGER STREAM SAMPLING PROGRAMS. (W69-02614).

00004. SYSTEMS ANALYSIS: AN ECONOMIST'S VIEW.

TYBOUT, R.A.
SYSTEMS APPROACH TO WATER QUALITY IN THE GREAT LAKES, PROC 3RD ANNU SYMP WATER RESOURCES RESEARCH, P 117-126, OHIO STATE UNIVERSITY, SEPT 1967.

THREE APPROACHES TO THE PROBLEM OF OPTIMALLY ATTAINING WATER QUALITY STANDARDS IN A HYPOTHETICAL LAKE ILLUSTRATED THE INTERDEPENDENCY OF ECONOMICS AND SYSTEMS ANALYSIS AND THE PROBLEM OF PHILOSOPHICAL APPROACH IN SETTING AND ADMINISTERING OF THOSE STANDARDS. SYSTEM 1 CALLED FOR THE SOLUTION OF A SIMPLE LINEAR MODEL, WHERE THE COSTS OF POLLUTION REMOVAL FOR ALL USERS OF A LAKE WERE EQUATED TO THE COSTS OF ALL POLLUTION IMPOSED ON THE LAKE BY POLLUTERS. THE QUALITY STANDARD FOR THE LAKE WAS ASSUMED GIVEN. SYSTEM 2 MAXIMIZED THE UTILITIES TO ALL INDIVIDUALS FROM POLLUTANT AND NON-POLLUTANT GENERATING PRODUCTS, SUBJECT TO THEIR BUDGET CONSTRAINTS. SYSTEM 3 MAXIMIZED THE BENEFIT-COST RATIOS OF VARIOUS PRODUCTS, SUBJECT TO BUDGET CONSTRAINTS, ASSUMING BENEFITS AND COSTS WERE QUANTIFIABLE. THE PROBLEMS AND MERITS OF EACH APPROACH AND THEIR COMBINATION WERE DISCUSSED. (W69-02614).

00005. A DYNAMIC MODEL FOR WATER QUALITY CONTROL.

KERRI, K.D.
J WATER POLLUTION CONTROL FED., 33(5), 772-786, 1967.

FROM THE CONCLUSION OF AN EARLIER PAPER THAT THE ESTABLISHMENT OF STREAM QUALITY STANDARDS OBTAINED BY NONLINEAR PROGRAMMING TECHNIQUES RESULTED IN LOWER TREATMENT COSTS THAN THE ENFORCEMENT OF EFFLUENT STANDARDS, A PRESENTATION WAS MADE FOR THE ORGANIZATION OF RIVER BASIN WASTE TREATMENT ASSOCIATIONS. COST CURVES SHOWED THEM IF ALL PLANTS IN THE ASSOCIATION WERE BUILT AS FIXED OUTPUT CONVENTIONAL PLANTS, EXCEPT FOR ONE PIVOTAL PLANT WHICH COULD BE OPERATED OVER A WIDE RANGE, LARGE ECONOMIES COULD RESULT. THE PIVOTAL PLANT WOULD PREFERABLY HAVE A LOW MARGINAL TREATMENT COST, A LARGE DISCHARGE, AND WOULD BE LOCATED JUST ABOVE THE CRITICAL REACH. THE SELECTION AND SIZE OF THE TREATMENT FACILITIES WOULD BE CHOSEN BY COMPUTER ON THE BASIS OF THE

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MARGINAL AND AVERAGE COST CURVES FOR THE PLANTS. CAPACITY OF THE SYSTEM WOULD BE SIZED ON THE 10 TO 20 YEAR LOW FLOW USING REAL OR SIMULATED HYDROLOGIC DATA. THE DYNAMIC CONDITIONS OF THE ASSOCIATION (EXPANSION OF MUNICIPALITIES AND FIRMS AND CHANGING STANDARDS) WERE DISCUSSED, AND THE RESULTS OF NUMERICAL EXAMPLES FOR NEW FIRMS ENTERING THE ASSOCIATION WERE TABLED. (W69-02615).

00006. POLLUTING SOLUTION--A TOWNSHIP SEWERAGE SYSTEM.

MATTAZ, R.C.
ILLINOIS BAR JOURNAL, 52(10), 864-869, 1964.

THE AUTHOR CONTENDS THAT TOWNSHIP SEWERAGE SYSTEMS ARE THE MOST PRACTICAL METHOD OF POLLUTION CONTROL IN ILLINOIS. SUCH SYSTEMS CAN BE FINANCED BY BOND ISSUUES, FEDERAL FUNDS FOR UP TO 30 PERCENT OF CONTRUCTION COSTS, AND CONNECTION FEES TO THE SEWER USERS FOR THE PRIVILEGE OF CONNECTING TO THE SYSTEM. THE ONLY LEGAL PREREQUISITE IS THE ADOPTION BY THE BOARD OF TOWN AUDITORS OF AN ORDINANCE DESCRIBING THE PROJECT AND THE PROPOSED BOND ISSUE. ADDITIONAL ORDINANCES SHOULD BE PASSED TO REGULATE MATERIAL AND METHODS USED IN THE ACTUAL CONNECTION AND TO PROVIDE FOR TOWNSHIP INSPECTION. CONNECTION TO THE SYSTEM MAY BE ENCOURAGED BY DISCOUNTING CONNECTION FEES IN THE FIRST YEARS OF OPERATION. EASEMENT PROBLEMS MAY BE LARGELY OVERCOME BY PROVISIONS IN THE SEWER USER CONTRACTS GRANTING BLANKET EASEMENTS TO THE TOWNSHIP. ADDITIONAL EASEMENTS MUST BE OBTAINED BY INDIVIDUAL NEGOTIATION. AFTER ALL EASEMENTS ARE OBTAINED ORDINANCES SHOULD BE PASSED MAKING CONNECTION MANDATORY AND DEFINING AS NUISANCES ANY STRUCTURES NOT CONNECTED. SUCH ORDINANCES SEEM TO BE ENFORCEABLE UNDER EXISTING CASES, BUT THE AUTHOR RECOMMENDS THAT THE STATE LEGISLATURE EXPRESSLY GRANT THIS POWER. (W68-00142).

00007. EFFLUENT CHARGES; A METHOD OF ENFORCING STREAM STANDARDS.

DELOGU, O.E.
MAINE LAW REVIEW, 19(1), 29-47, 1967.

WATER QUALITY AND NOT QUANTITY IS OUR MOST PRESSING RESOURCES PROBLEM. FEDERAL AND STATE GOVERNMENTS ARE BECOMING INCREASINGLY AWARE OF THEIR RESPONSIBILITIES IN POLLUTION CONTROL AND ABATEMENT. THE MAINE LEGISLATURE HAS CREATED POTENTIALLY EFFECTIVE POLLUTION CONTROL MACHINERY, BUT THIS HAS NOT BEEN FULLY IMPLEMENTED, CAUSING CONTINUED DETERIORATION OF THE STATE'S WATERS. THE FINANCIAL AND POLITICAL COMMITMENT NECESSARY TO ATTAIN WATER QUALITY STANDARDS HAS BEEN SO LARGE THAT STATES HAVE BEEN UNWILLING OR UNABLE TO MEET IT. A MODIFIED CONCEPT OF EFFLUENT CHARGES WOULD SHIFT THE COST OF THE PRESENT METHOD OF WASTE DISPOSAL (DUMPING WASTES INTO THE STATE'S WATERS) FROM THE STATE AND DOWNSTREAM WATER USERS TO THE ECONOMIC UNIT ACUTALLY CREATING AND DISPOSING OF THE WASTE. THE PRESENT METHOD OF WASTE DISPOSAL ALLOWS PRODUCERS OF WASTE PRODUCTS TO SHIFT PART OF THEIR PRODUCTION COSTS TO THE STATE AND DOWNSTREAM USERS, WHO MUST TREAT THE WATER OR FOREGO ITS USE. USING EFFLUENT CHARGES, THE TOTAL AMOUNT COLLECTED BY CHARGES WOULD BE EQUAL TO THE COST OF BUILDING AND MAINTAINING TREATMENT FACILITIES TO KEEP WATER QUALITY AT STANDARDS ESTABLISHED FOR THE WATER. THE CHARGE TO EACH ECONOMIC UNIT WOULD BE PROPORTIONAL TO ITS PRO RATA SHARE OF POLLUTION. SEVERAL BENEFITS ARE LISTED. (W68-00115).

00008. THE LEGISLATIVE APPROACH TO AIR AND WATER QUALITY.

EDWARDS, M.N.
NATURAL RESOURCES LAWYER, 1(1), 58-69, 1968.

THE FEDERAL WATER POLLUTION CONTROL ACT IS THE BASIC AUTHORITY FOR THE DEPARTMENT OF THE INTERIOR IN THE FIELD OF PREVENTION, CONTROL, AND ABATEMENT OF WATER POLLUTION. THIS LAW CONTINUES THE BASIC RESPONSIBILITY FOR CONTROLLING POLLUTION IN THE STATES COUPLED WITH PROVISIONS FOR RESEARCH, MUNICIPAL WASTE DISPOSAL, AND FINANCING. THIS ACT WAS AMENDED IN 1961 BY THE WATER QUALITY ACT AND BY THE CLEAN WATER RESTORATION ACT OF 1966. THE WATER QUALITY ACT IS UNIQUE IN ESTABLISHING QUALITY STANDARDS FOR INTERSTATE WATERS TO BE PREPARED FIRST BY THE STATES. UPON FAILURE TO ESTABLISH STANDARDS OR UPON REJECTION BY THE FEDERAL GOVERNMENT OF THE PROPOSED STANDARDS, THE SECRETARY OF THE INTERIOR IS AUTHORIZED TO IMPOSE STANDARDS. THE CLEAN WATER RESTORATION ACT IS DESIGNED TO PROMOTE COMPREHENSIVE RIVER BASIN PLANNING AND IS COUPLED WITH MORE LIBERALIZED FUNDING PROVISION FOR PREVIOUS PROGRAMS. FEDERAL STATUTES PROVIDE TWO METHODS FOR ENFORCEMENT OF THEIR PROVISIONS. THE FIRST PROVIDES FOR LENGTHY ADMINISTRATIVE PROCEDURES, WHICH, IF SUCCESSFUL, MAY BE FOLLOWED BY COURT ACTION. THE SECOND PROVIDES FOR ABATEMENT ACTIONS TO BE BROUGHT BY FEDERAL ATTORNEYS AFTER NOTICE IF DISCHARGE CAUSES WATER TO FALL BELOW WATER QUALITY STANDARDS. (W68-00105).

00009. COSTS DIVE AS WEIRTON RE-USES MILL ROLL COOLANT.

STEEL, 162(24), 78, 80, 1968.

DESCRIBED IS NATIONAL STEEL'S WEIRTON STEEL DIVISION PLANT, WEST VIRGINIA. IT USES POTABLE WATER TO COOL MILL ROLLS AND IS SAVING MONEY AND WATER WHILE MAINTAINING QUALITY CONTROL STANDARDS. A RECIRCULATING SYSTEM WITH VACCUUM FILTER REPLACES THE OLD COOLANT SYSTEM OF WATER AND OIL DIRECTLY APPLIED TO THE ROLLS. THE OLD SYSTEM WITH CONTINUOUS DISPOSAL OF FINES AND OXIDES AND OTHER CONTAMINANTS IS REPLACED BY 8 FILTERS. EACH PAIR OF FILTERS HANDLES 3,000 GPM, BUT IN EMERGENCIES ONE FILTER CAN HANDLE THE FLOW. BECAUSE A CONSTANT FLOW OF FRESH UNIFORM COOLANT CAN NOW BE DELIVERED, THE NEED FOR LARGE STORAGE TANKS IS ELIMINATED. FORMERLY, THE PLANT CONSUMED 30 MGD OF RIVER WATER. LOSSES OF OIL AND NECESSARY CHEMICAL WATER TREATMENT COST $1 MILLION A YR. VARIATIONS IN RIVER WATER TEMPERATURE CAUSED PROBLEMS IN QUALITY CONTROL OF PRODUCT. ONLY 50,000 GPD ARE USED WITH THE NEW SYSTEM AND FLUID LOSSES OCCUR ONLY THROUGH EVAPORATION AND LEAKAGE. COSTS HAVE BEEN CUT TO $1.50 PER HOUR PER ROLLING MILL FOR EACH SET OF 4 FILTERS. (W68-00032).

00010. A SAMPLE DESIGN FOR INVESTIGATING THE EFFECTS OF STREAM POLLUTION ON

REFERENCE LIST

WATER-BASED RECREATION EXPENDITURES.

LONG, W. H.
WATER RESOURCES BULLETIN, 4(3), 19-26, 1968.

A SAMPLE DESIGN IS PRESENTED FOR SELECTING STREAMS IN AN INVESTIGATION OF THE RELATION BETWEEN WATER POLLUTION AND WATER BASED RECREATION EXPENDITURES. THE DESIGN IS A PROPORTIONAL SAMPLE OF CLUSTERS OF STREAMS STRATIFIED IN A TWO-WAY SCHEME. THE CLUSTERING IS ACHIEVED BY SAMPLING 7 1/2 MINUTE TOPOGRAPHICAL MAPS, AND THE STRATIFICATION BY USING MEASURES CONNECTED WITH WATER POLLUTION TO CLASSIFY THE CLUSTERS. THE DESIGN IS BASED ON CONSIDERATION OF ECONOMY IN DATA COLLECTION AND COMPUTATIONAL EFFICIENCY. A DISTINCTIVE FEATURE OF THE DESIGN IS THAT DATA COLLECTED ARE TO BE USED IN A REGRESSION ANALYSIS. THUS, THE SAMPLE SIZE IS DETERMINED BY TRYING TO ACHIEVE A GIVEN DEGREE OF PRECISION FOR THE REGRESSION COEFFICIENTS. (W69-02357)

00011. MODERN SEWER-SERVICE CHARGES, PART 1--WHY CITIES NEED THEM.

HEARINGS-SUBCOMMITTEE ON AIR AND WATER POLLUTION-COMMITTEE ON PUBLIC WORKS U S SENATE- 90TH CONGRESS, SECOND SESSION, 67-71, 1968.

THE REASON FOR THE USE OF SEWER SERVICE CHARGES IS THAT THEY AVOID TAXES. THE PRINCIPLE BENEFIT IS THAT THE PUBLIC DOES NOT LIKE TAXES BUT WILL ACCEPT A CHARGE THAT PAYS FOR A SERVICE THAT IT COMPREHENDS. SHIFTING THE FINANCIAL BURDEN OF SEWERAGE WORKS FROM AD VALOREM TAXES TO SEWER-SERVICE RESULTS IN A WIDER ARRAY OF CONTRIBUTORS. CHURCHES, SCHOOLS, AND OTHER GOVERNMENTAL UNITS WHICH DO NOT PAY PROPERTY TAXES IMMEDIATELY BECOME PAYING CUSTOMERS. ADDITIONALLY, THE HOMEOWNER PAYS MORE NEARLY IN PROPORTION TO USE AND COMMERCIAL USERS PAY LIKEWISE RATHER THAN BEING TAXED ON ASSESSED VALUATION. THE SERVICE RATES OF CHATTANOOGA, TENNESSEE, ARE PRESENTED. (W69-02065).

00012. STAGE DEVELOPMENT OF WASTEWATER TREATMENT WORKS.

LYNN, W.R.
J WATER POLLUTION CONTROL FED., 36(6), 1964.

A DYNAMIC MODEL WAS PRESENTED TO DETERMINE THE TIMING AND FINANCING OF SANITARY FACILITIES IN RESPONSE TO A GROWING POPULATION. THE MODEL INCORPORATED A DETAILED DESCRIPTION OF THE FLOW OF FUNDS AT THE TIMES OF ACTUAL OCCURRENCE. A LINEAR PROGRAMMING TECHNIQUE WAS USED TO DETERMINE THE TIMING OF CONSTRUCTION, THE FUNDS BORROWED, LOAN REPAYMENT SCHEDULES, FUNDS INVESTED, AND THE SERVICE CHARGE. ILLUSTRATIVE PROBLEMS WERE SOLVED USING EXISTING COST DATA. IT WAS CONCLUDED THAT THE MODEL IS APPLICABLE IN PLANNING AND EVALUATING THE FINANCING AND ITS TIMING OF SANITARY ENGINEERING CONTRUCTION PROJECTS. (W68-00385).

00013. DEVELOPMENT OF OPTIMIZATION MODELS FOR CARBON BED DESIGN.

DOSTAL, K.A.; HARRINGTON, R. M.; CLARK, R.M.
JOURNAL AMERICAN WATER WORKS ASSOCIATION 58(9) 1170-1186, 1966.

ECONOMIC AND TECHNOLOGICAL FACTORS WERE INCORPORATED INTO TWO LINEAR PROGRAMMING MODELS TO DETERMINE THE LEAST COST PRELIMINARY DESIGN FOR THE GRANULAR-ACTIVATED CARBON UNIT PROCESS. ONLY CONTINUOUS REACTIVATION WAS CONSIDERED. THE OBJECTIVE WAS TO MINIMIZE THE PRESENT VALUES OF THE TOTAL COST. ACTUAL DATA WERE USED AND EXAMPLE PROBLEMS WERE SOLVED. EACH MODEL WAS SOLVED TO DETERMINE THE FILTER SIZE, FURNACE CAPACITY, AND THE RATE OF REACTIVIATION. THE SECOND MODEL ALSO SPECIFIED THE LEVEL OF OFF-LINE STORAGE. IT WAS CONCLUDED THAT: (1) LOSSES OF CARBON STRONGLY AFFECT PRESENT VALUE, (2) CHANGES IN THE ECONOMIC TIME HORIZON AND THE UNIT COST OF REACTIVATING CARBON HAVE AN INFLUENCE ON PRESENT VALUE, (3) THE MODELS CAN BE USED FOR PRELIMINARY DESIGN, AND (4) DURING SEASONAL DEMAND PATTERNS, IT MAY BE MORE ECONOMICAL TO OPERATE THE FURNACE ON AN INTERMITTENT BASIS. (W68-00390).

00014. SYSTEMS ANALYSIS FOR PLANNING WASTE-WATER TREATMENT PLANTS.

LYNN, W.R.; LOGAN, J.A.; CHARNES, A.
J WATER POLLUTION CONTROL FED., 34(6), 565-581, 1962.

A SEQUENCE OF SEWAGE TREATMENT UNIT PROCESSES WERE EXAMINED TO DETERMINE THE MINIMUM COST COMBINATION OF PROCESSES NECESSARY TO SATISFY THE EFFLUENT REQUIREMENTS. A CONSTANT INPUT LEVEL OF BIOCHEMICAL OXYGEN DEMAND WAS ASSUMED. THE EFFICIENCIES OF THE UNIT PROCESSES WERE CONSIDERED AS CONSTANT. AN EXAMPLE PROBLEM WAS SOLVED, USING EXISTING DATA, TO ELUCIDATE THE MATHEMATICS OF NETWORK ANALYSIS. THE NETWORK FORMULATION WAS TRANSFORMED INTO A DYADIC MODEL. AN EFFICIENT PROCEDURE FOR CALCULATING THE LEAST COST SOLUTION WAS PRESENTED. THIS WAS ONE OF THE FIRST PAPERS WHICH INTRODUCED SYSTEMS ANALYSIS AS A TECHNIQUE FOR DETERMINING AN ECONOMICAL COMBINATION OF UNIT PROCESSES NECESSARY TO REMOVE A SPECIFIC QUANTITY OF BIOCHEMICAL OXYGEN DEMAND. (W68-00384).

00015. USING WASTE HEAT FOR FISH FARMING.

MARTINO, P.A.; MARCHELLO, J.M.
OCEAN IND, 3(4) 36-39, 1968.

QUANTITATIVE EVALUATION IS MADE OF THE POSSIBILITY OF UTILIZING INDUSTRIAL WASTE HEAT, SUCH AS FROM A SEA COAST NUCLEAR POWER PLANT, FOR CONVECTIVELY PUMPING UP NUTRIENT-RICH DEEP WATER FOR FISH FARMING. THERMO-NUTRIENT PUMPING CONDITIONS ARE DESCRIBED AND ILLUSTRATED. DESIGN CRITERIA ARE OUTLINED FOR VARIOUS OPERATING SCHEDULES. CURVES SHOW DIFFERENT EQUATIONS FOR PIPE DIAMETERS AND FLOW RATES. COST ESTIMATES ARE GIVEN. FOR EXAMPLE, A 1-METER DIAMETER VERTICAL PIPE WITH DELTA T EQUALLING 5 DEG C CAN DELIVER 300 KG/SEC OF NUTRIENT-RICH WATER WHEN 60 KG/SEC OF HEAT EXCHANGER WATER IS INJECTED AT THE BOTTOM; THIS CAN PRODUCE ABOUT 3,000 KG OF EDIBLE FISH. PIPE DIAMETER WOULD HAVE TO BE MULTIPLIED IN ACCORDANCE WITH ENVIRONMENTAL CONDITIONS, AMOUNT OF AVAILABLE HEAT, AND COST-BENEFIT RATIO.

A SUGGESTION IS MADE FOR A JOINT SCHEME BETWEEN A COASTAL NUCLEAR AND DESALINATION PLANT AND OFFSHORE OIL FIELDS AND A FISH FARMING PROJECT. A PLANT PRODUCING 100 MGD OF FRESH WATER WOULD RETURN 10,000 KG/SEC OF HEAT EXCHANGE WATER TO THE OCEAN. (W68-00338)

00016. A SYNERGISTIC APPROACH TO PHOSPHORUS REMOVAL.

SHERWOOD, R.J.
J OF CIV ENG, AM SOC CIV ENG, 32-35, 1968.

THE PHOSPHORUS IN SEWAGE HAS BEEN HELD RESPONSIBLE FOR THE EXCESSIVE ALGAL GROWTH IN LAKES INTO WHICH DOMESTIC SEWAGE IS DISCHARGED, BUT THE EXTENT TO WHICH IT MUST BE ELIMINATED IS NOT KNOWN. THE DESIGN FACTORS IN A PHOSPHATE-REMOVAL PLANT ARE: THE RATIO OF SOLUBLE TO TOTAL PHOSPHATE, WATER ALKALINITY AND HARDNESS, BOD REMOVAL REQUIRED, PHOSPHORUS REMOVAL REQUIRED, AND THE RATIO OF SOLUBLE BOD TO TOTAL BOD. THE BIOCHEMICAL REMOVAL OF PHOSPHORUS FROM WASTES BY THE ACTIVATED SLUDGE METHOD IS EFFECTIVE IN CERTAIN RATIOS OF INFLUENT BOD TO PHOSPHORUS. THE REMOVAL RATE IS HIGH WHEN THE SLUDGE AGE IS 0.5-1 DAY, BUT IS GREATLY REDUCED WHEN THE AGE IS 15-25 DAYS. ALGAE CAN HELP IN SEWAGE STABILIZATION IN THIS CYCLE: ALGAE PRODUCE OXYGEN WHICH COMBINES WITH ORGANIC MATTER. THIS, BY BACTERIAL ACTION RELEASES CARBON DIOXIDE, AMMONIA, PHOSPHATE, AND WATER, WHICH ARE THEN USED BY ALGAE TO PRODUCT MORE OXYGEN. TERTIARY TREATMENT BY THE ADDITION OF CHEMICALS IS EFFECTIVE, BUT ITS EXPENSE INCREASES GREATLY AFTER THE INITIAL PHOSPHORUS REMOVAL BY THE FIRST APPLIED DOSES. LIME IS A LESS EXPENSIVE ADDITIVE THAN ALUM OR AN IRON SALT AND IS ALSO EFFECTIVE IN PRIMARY PHOSPHATE COAGULATION. (W68-00256)

00017. PHOSPHORUS REMOVAL BY HIGH-DENSITY, SOLIDS-CONTACT TERTIARY TREATMENT.

GARLAND, C.F.
WORKSHOP ON PHOSPHORUS REMOVAL TECHNOLOGY, FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CHICAGO, ILLINOIS, 1968.

THE DENSATOR UNIT WAS DEVELOPED (FULLER CO OF TUCSON, ARIZ) TO SUPPLEMENT PHYSICAL-CHEMICAL PROCESSES OF SEWAGE SEPARATION. STRONG DOSAGES OF LIME, IRON, ALUM, OR COMBINATIONS OF THEM, ARE KNOWN TO BE EFFECTIVE IN REMOVING PHOSPHORUS. LIME IS THE MOST EFFECTIVE OF THESE ADDITIVES. THE UNIT PROVIDES HIGH-DENSITY, SOLIDS CONTACT TREATMENT IN 3 PHASES: (1) VIGOROUS MIXING OF WASTEWATER, LIME, AND A CONTROLLED VOLUME OF RECIRCULATED DENSE SOLIDS, (2) FLOCCULATION, AND (3) SOLIDS SEPARATION, THESE BEING RECIRCULATED TO (1). TESTS OF 10 PILOT PLANTS INDICATE THAT THE ADDITION OF LIME IS INCREASINGLY EFFECTIVE IN PHOSPHORUS REMOVAL AS PH INCREASES, BUT THAT THE EXCESSIVE PH OF LIME TREATED EFFLUENT MAY REQUIRE RECARBONATION BEFORE DISCHARGE. THE UNIT PERMITS SPLIT TREATMENT AND IMPROVED AUTOMATIC CONTROLS FOR LIME AS ADJUSTED TO THE RATIO OF ALKALINITY AND CALCIUM HARDNESS OF THE INFLUENT WASTEWATER. FILTRATION FURTHER REDUCES PHOSPHORUS CONTENT AS WELL AS BOD AND SUSPENDED SOLIDS. THIS UNIT COMBINED WITH THE BIOLOGICAL REMOVAL OF SOLUBLE ORGANICS IS EFFECTIVE. THE OPERATING COST OF THE 2-STAGE UNIT IS SOMEWHAT HIGHER, BUT THE INITIAL COST IS LOWER THAN THE USUAL 1-STAGE SYSTEM. THE HIGH-QUALITY WATER PRODUCED BY THIS UNIT NOW COSTS ABOUT 40 CENTS/1000 GAL. (W68-00254)

00018. FWPCA PROPOSES...A 20TH CENTURY PROGRAM FOR WATER POLLUTION CONTROL.

NALESNIK, R.P.
WATER AND WASTES ENGINEERING, 5(2), 59-62, FEB 1968.

THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION RECEIVED A MANDATE FROM CONGRESS IN THE CLEAN WATER RESTORATION ACT OF 1966, TO ASSESS THE NATIONAL REQUIREMENTS AND RELATED COSTS FOR TREATING MUNICIPAL, INDUSTRIAL, AND OTHER EFFLUENTS. THE UNITED STATES HAS THE TECHNICAL POWER TO MANAGE THE COMPLEX WATER POLLUTION PROBLEMS CAUSED BY INCREASED URBANIZATION AND INDUSTRIALIZATION, IF FINANCING CAN BE PROVIDED. THE WATER POLLUTION CONTROL ADMINISTRATION IS NOW WORKING TO IDENTIFY POLLUTION PROBLEMS AND DETERMINE THE COST OF ALTERNATE SOLUTIONS. THE ADVVANTAGES AND DISADVANTAGES OF AUTOMATIC DATA PROCESSING AND INCREASED COMPUTER USE ARE UNDER STUDY. REGIONAL OFFICES ARE FOCUSING ON THE POTENTIAL BENEFIT OF POLLUTION CONTROL AND ABATEMENT ACTION PROGRAMS UNDER TWENTY MAJOR RIVER BASIN MANAGERS. FEDERAL ASSISTANCE IS BEING PROVIDED TO STATE WATER QUALITY CONTROL AGENCIES, AND IN THE MONITORING OF STATE WATER STANDARDS. CHARTS SHOWING MUNICIPAL, INDUSTRIAL, AND AGRICULTURAL WATER USE, 1900-1980, ARE INCLUDED. TABLES SHOWING SUFFICIENCY OF FUTURE URBAN WATER SUPPLIES, AND ALTERNATE MEANS OF MEETING FUTURE DEMANDS ARE PROVIDED. A PROGRAMMED APPROACH TO DETERMINING AN INDUSTRIAL WASTE PROFILE IS GIVEN. (W68-00214)

00019. OPTIMIZATION OF THE HYDRAULIC REGIME OF ACTIVATED SLUDGE SYSTEMS.

ERICKSON, L.E.; FAN, L.T.
J WATER POLLUTION CONTROL FED., 40(3), 1968.

THE DESIGN OF ACTIVATED SLUDGE TANKS COMPOSED OF SEVERAL COMPLETELY-MIXED AERATION TANKS CONNECTED IN SERIES WERE OPTIMIZED AND COMPARED WITH THE RESULTS OF A SINGLE COMPLETELY-MIXED AERATION TANK. THE OPTIMAL SOLUTIONS WERE DEPENDENT ON THE FLOW INTO THE SYSTEM, THE RECYCLE FLOW, AND THE MIXING WITHIN THE SYSTEM. THE CONCENTRATION OF ORGANIC MATTER, THE ORGANISM CONCENTRATION, AND THE VOLUME OF EACH AERATION TANK WERE THE UNKNOWN VARIABLES. A DIRECT SEARCH OPTIMIZATION TECHNIQUE WAS USED TO SYSTEMATICALLY FIND THE OPTIMUM. THE RESULTS OF THE ANALYSIS INDICATED (1) THE TWO-AERATION-TANK ACTIVATED SLUDGE SYSTEM REQUIRED A SMALLER THEORETICAL VOLUME THAN THE SINGLE TYPE AERATION-TANK SYSTEM AND (2) THE ORGANIC NUTRIENT CONCENTRATION IS A VERY IMPORTANT VARIABLE IN DESIGN. HAS 22 REFERENCES. (W68-00383)

00020. A MANAGEMENT MODEL FOR WATER QUALITY CONTROL.

REVELLE, C.S.; LOUCKS, D.P.; LYNN, W.R.
J WATER POLLUTION CONTROL FED., 39(7), 1164-1183, 1967.

A LINEAR PROGRAMMING MODEL WAS PRESENTED TO ELUCIDATE THE MATHEMATICAL FOUNDATIONS OF SYSTEMS ANALYSIS AS APPLIED TO THE PROBLEM OF DETERMINING THE MINIMUM COST COMBINATION OF

PLANT EFFICIENCIES NECESSARY TO MAINTAIN LEVELS OF DISSOLVED OXYGEN IN A STREAM. THE CONSTRAINTS OF THE PROBLEM WERE FORMED FROM : (1) THE DEFINITION OF PLANT EFFICIENCIES, (2) INVENTORY EQUATIONS ON BIOCHEMICAL OXYGEN DEMAND AND DISSOLVED OXYGEN, AND (3) QUALITY CONSTRAINTS ON DISSOLVED OXYGEN. A NUMERICAL EXAMPLE WAS SOLVED USING ARTIFICIAL DATA. THE PROCEDURE ILLUSTRATED A MATHEMATICAL PROGRAMMING FORMULATION THAT: (1) WAS NOT AN APPROXIMATION TO THE OXYGEN SAG EQUATION; (2) EASILY HANDLED TRIBUTARIES; (3) SPECIFIED MAXIMUM VIOLATIONS OF THE DISSOLVED OXYGEN STANDARDS; AND (4) WAS SOLVED BY LINEAR PROGRAMMING TECHNIQUES. AN APPENDIX ON THE SPACING OF QUALITY CONSTRAINTS WAS INCLUDED. THERE ARE 15 REFERENCES. (W68-00391).

00021. AN ANALYSIS OF THE ECONOMICS OF WASTEWATER TREATMENT.

LOGAN, J.A.; HATFIELD, W.A.; RUSSELL, G.S.
J WATER POLLUTION CONTROL FED., 34(9), 860-882, 1962.

CONSTRUCTION AND OPERATING COSTS FOR WASTE TREATMENT PLANTS WERE OBTAINED FROM EXISTING PLANTS BY MEANS OF SITE VISITS, AND FROM SERIES OF PLANTS DESIGNED FOR A SPECIFIC AREA. TOTAL COSTS WERE OBTAINED FOR PRIMARY, HIGH-RATE FILTER, STANDARD-RATE FILTER, AND ACTIVATED SLUDGE PLANTS. UNIT COSTS AND EFFICIENCY ASPECTS WERE DETERMINED FOR USE IN FUTURE STUDIES WHICH WILL BE ORIENTED TOWARDS FINDING THE MINIMUM COST DESIGN. SOME OF THE DIFFICULTIES IN ANALYZING DATA FROM EXISTING PLANTS WERE: (1) VARIATIONS IN QUALITY AND QUANTITY INPUTS, (2) VARIATION IN DESIGN CRITERIA, (3) VARIATIONS IN THE DEFINITIONS OF EACH UNIT PROCESS, AND (4) LOCAL DIFFERENCES IN LABOR, TOPOGRAPHIC, AND GEOGRAPHIC CONDITIONS. (W68-00392).

00022. OPTIMIZATION ANALYSIS FOR BIOLOGICAL FILTER DESIGN.

GALLER, W.S., GOTAAS, H.B.
ASCE J SANITARY ENGINEERING, 92(SA1), PAPER 4684, 163-182, FEB 1966.

LINEAR PROGRAMMING WAS USED IN THE DESIGN OF BIOLOGICAL FILTERS. THE OBJECTIVE WAS TO MINIMIZE THE COSTS OF OPERATION AND CONSTRUCTION. GIVEN A WASTE FLOW AND A BIOCHEMICAL OXYGEN DEMAND, THE ANALYSIS SELECTED THE RADIUS, DEPTH, AND RECIRCULATION RATIO OF EACH FILTER. THREE TEMPERATURES, SIX BIOCHEMICAL OXYGEN DEMANDS, AND FLOW RATES FROM ONE TO TWENTY MILLION GALLONS PER DAY WERE USED AS INPUT DATA. AN EXAMPLE PROBLEM WAS SOLVED. THE RESULTS DEMONSTRATED THAT: (1) VARIATIONS IN DESIGN ARE RELATED TO INPUT CONDITIONS, (2) VARIATIONS IN COST PARAMETERS WITHIN REASONABLE LIMITS DO NOT AFFECT DESIGN VARIABLES, AND (3) THE MODELS CAN BE USED FOR DETERMINING MORE EFFECTIVE DESIGNS. (W68-00393).

00023. COMPUTER AIDED DESIGN OF WASTE COLLECTION AND TREATMENT SYSTEMS.

DEININGER, R.A.
PROC. SECOND ANNUAL AMERICAN WATER RESOURCES CONFERENCE, CHICAGO, ILL. 247-258, NOV. 1966.

A SUMMARY OF THREE RESEARCH TOPICS CONCERNED WITH THE FEASIBILITY AND LIMITATIONS OF THE DESIGN OF WASTE COLLECTION AND TREATMENT SYSTEMS BY DIGITAL COMPUTERS WAS PRESENTED. THE RESULTS OF THE THREE RESEARCH TOPICS WERE: (1) THE MINIMUM COST OF EXCAVATION AND PIPE FOR A SEWER APPROACH TO THE DESIGN OF WASTE COLLECTION AND TREATMENT SYSTEMS WITH THE OBJECTIVE OF MINIMIZING THE COLLECTION AND TREATMENT COSTS WAS PRESENTED. AN ITERATIVE PROCEDURE USING LINEAR APPROXIMATIONS OF THE OBJECTIVE FUNCTION WAS USED TO SOLVE THE PROBLEM, AND (3) AUTOMATIC PLOTTING EQUIPMENT WAS EXAMINED FOR THE GENERATION OF CONSTRUCTION PLANS FOR A TREATMENT PLANT. THE CONCEPTS OF TIME-SHARING COMPUTER SYSTEMS WERE USED FOR PLOTTING. (W68-00395).

00024. LINEAR PROGRAMMING APPLIED TO WATER QUALITY MANAGEMENT.

REVELLE, C.S.; LOUCKS, D.P.; LYNN, W.R.
WATER RESOURCES RESEARCH, 4(1), 1-9, 1968.

A LINEAR PROGRAMMING FORMULATION TO MINIMIZE THE COST OF WASTE TREATMENT IN THE WILLAMETTE RIVER BASIN SUBJECT TO MAINTAINING A MINIMUM CONCENTRATION OF DISSOLVED OXYGEN WAS PRESENTED. ACTUAL DATA FROM THE WILLAMETTE RIVER BASIN WAS USED. A COMPARISON WAS MADE TO A DYNAMIC PROGRAMMING SOLUTION. BOTH TECHNIQUES YIELDED ESSENTIALLY THE SAME RESULTS. OPPORTUNITIES FOR COST REDUCTION WERE EXAMINED BY STUDYING THE DUAL VARIABLES. IT WAS CONCLUDED THAT SUCH INFORMATION COULD BE EXTREMELY IMPORTANT TO THOSE RESPONSIBLE FOR WATER QUALITY MANAGEMENT. (W68-03397).

00025. ESTUARINE WATER QUALITY MANAGEMENT AND FORECASTING.

THOMANN, R.V.; SOBEL, M.J.
ASCE J SANITARY ENGINEERING, 90(SA5), PAPER 4116, 9-36, 1964.

TIME SERIES AND MATHEMATICAL PROGRAMMING TECHNIQUES WERE USED FOR FORECASTING DISSOLVED OXYGEN AND FORMULATING THE OBJECTIVE FUNCTION AND CONSTRAINTS FOR THE OPTIMAL MANAGEMENT OF WASTE INPUTS. DISSOLVED OXYGEN DATA FROM THE DELAWARE ESTUARY WERE USED. ILLUSTRATIVE PROBLEMS WERE STRUCTURED TO SHOW THE MANAGERIAL PROBLEMS THAT CAN BE SOLVED. THE EXTENT OF THE FORECASTING SCHEME DEPENDS UPON THE KNOWLEDGE OF THE PARAMETERS USED IN THE TRANSFER FUNCTION, AND THE WASTE INPUT DATA. DIFFICULTIES THAT ARE ASSOCIATED WITH ATTEMPTS TO CONTROL TRANSIENT FLUCTUATIONS OF QUALITY WERE EXAMINED. SALINITY INTRUSION PROFILES WERE USED TO ILLUSTRATE THE TRANSIENT CONTROL PROBLEMS. (W68-00398).

00026. PROGRESS TOWARDS OPTIMUM DESIGN OF DIATOMITE FILTER PLANTS.

BAUMANN, E.R.; CLEASBY, J.L.; REGUNATHAN, P.
5TH ANNUAL SANITARY AND WATER RESOURCES ENGINEERING CONFERENCE, VANDERBILT UNIVERSITY, 124-154, JUNE 2-3 1966.

AN OBJECTIVE OF THE STUDY WAS TO DEVELOP A RATIONAL MINIMUM COST DESIGN TECHNIQUE FOR DIATOMITE FILTERS. A COMPUTER PROGRAM WAS DEVELOPED FOR USE IN DETERMINING THE MINIMUM TOTAL COST BY ENUMERATING DIFFERENT COMBINATIONS OF DESIGN VARIABLES. THE DESIGN VARIABLES WERE FLOW RATE, BODY FEED CONCENTRATION, AND

TERMINAL HEAD LOSS. THE EFFECT OF PLANT SIZE WAS ALSO EVALUATED. THE CONCLUSIONS WERE: (1) THE COMPUTER PROGRAM CAN BE USED IN OPTIMIZATION STUDIES; (2) THE USE OF ONE DESIGN FILTRATION RATE FOR ALL TYPES OF WATER SHOULD BE AVOIDED; (3) PLANT SIZE HAS A SIGNIFICANCE ON TOTAL COST; AND (4) FILTERABILITY OF WATER IS VERY IMPORTANT. (W68-00399).

00027. THE APPLICATION OF OPTIMIZATION TECHNIQUES TO TEXTILES MILL WASTE TREATMENT.

DEBRUHL, H.M.; SMALLWOOD, C.

FIFTEENTH SOUTHERN WATER RESOURCES AND POLLUTION CONTROL CONFERENCE, NORTH CAROLINA STATE AT RALEIGH, APRIL 7, 1966.

LINEAR PROGRAMMING WAS USED IN MAXIMIZING PROFITS FOR A TEXTILE MILL OPERATION BY DETERMINING THE OPTIMAL PRODUCTION LEVEL. THE CONSTRAINTS OF THE PROBLEM WERE FORMED FROM THE MAXIMUM AND MINIMUM PRODUCTION LEVELS, THE MAXIMUM DISCHARGE OF BIOCHEMICAL OXYGEN DEMAND, AND THE SYSTEM CONFIGURATION. DATA WAS OBTAINED FROM THE LITERATURE. AN EXAMPLE PROBLEM WAS SOLVED ILLUSTRATING THE USE OF THE SIMPLEX TABLEAU. THE RESULTS DEMONSTRATED: (1) THE USE OF A MODEL TO DETERMINE PRODUCTION LEVELS; AND (2) THE VALUE OF IN-PLANT HOUSEKEEPING. (W68-00400).

00028. CAPACITY EXPANSION OF WATER TREATMENT FACILITIES.

MUHICH, A.J.

THESIS, HARVARD U., CAMBRIDGE, MASS., APRIL 1966.

MATHEMATICAL MODELS FOR THE MINIMUM CONSTRUCTION COSTS OF WATER TREATMENT PLANTS WERE PRESENTED TO DETERMINE THE LEVEL AND TIMING OF A CONSTRUCTION. THE OPTIMAL SOLUTIONS WERE RELATED TO THE INTEREST RATE, THE RATE OF GROWTH IN DEMAND, AND ECONOMIES OF SCALE INHERENT IN TREATMENT PLANT CONSTRUCTION. LINEAR AND GEOMETRIC GROWTH RATES WERE USED. CALCULUS TECHNIQUES WERE USED FOR THE EQUAL TIME INTERVAL CONSTRUCTION MODELS. A COMBINATION OF SAMPLING TECHNIQUES AND A GRADIENT NON-LINEAR PROGRAMMING TECHNIQUE WAS USED FOR THE UNEQUAL CONSTRUCTION TIME INTERVALS. ALLOWING UNEQUAL CONSTRUCTION INTERVALS MADE LITTLE DIFFERENCE IN THE RESULTS. EXISTING CONSTRUCTION COST DATA WERE USED. INTRODUCTION OF UNCERTAINTY HAD LITTLE EFFECT ON THE DECISION PROCESS. IT WAS CONCLUDED THAT EXISTING RULES OF THUMB USED FOR DESIGN INTERVALS CAUSED A COST INCREASE OF THREE TO FIVE PERCENT ABOVE THE OPTIMAL DESIGN. (W68-00401).

00029. A MODEL FOR QUANTIFYING FLOW AUGMENTATION BENEFITS. PROGRESS REPORT.

PYATT, E.E.

A PROGRESS REPORT TO FWPCA CONCERNING RESEARCH GRANT WP-01050-02, ENGINEERING AND INDUSTRIAL EXPERIMENT STATION, UNIVERSITY OF FLORIDA, 31 MAY 1968, 43 P.

THE 'LOW FLOW AUGMENTATION PROJECT', DESIGNATED WP-01050-02, HAS AS ITS OBJECTIVE THE DEVELOPMENT OF A GENERALIZED MATHEMATICAL MODEL OF A TYPICAL RIVER BASIN, WHICH IS SUSCEPTIBLE TO MANIPULATION SUCH THAT IT IS POSSIBLE TO ASSESS FUNCTIONAL RESPONSES OF SEWAGE TREATMENT LEVELS AND FLOW AUGMENTATATION CONJUNCTIVELY UTILIZED TO ACHIEVE SPECIFIED LEVELS OF STREAM WATER QUALITY. TO THIS END, THE PROJECT HAS BEEN SUBDIVIDED INTO SIX AVENUES OF INQUIRY. THE FIRST AVENUE HAS TO DO WITH THE FORMULATION OF PREDICTIVE EQUATIONS FOR 'ROUTING' ASSIMILATIVE CAPACITY INTO, THROUGH AND OUT OF RESERVOIRS. THIS FORMULATION, IN A SENSE, IS TO BE A STOCHASTIC VERSION--STOCHASTIC IN TERMS OF BOTH RUNOFF AND TEMPERATURE--OF EXTANT EQUATIONS, SUCH AS THOSE OF DOBBINS. THE SECOND PHASE WAS INITIATED IN EARLY SPRING 1967, WHEN MR. R. D. G. PYNE UNDERTOOK A STUDY OF 'COST CURVES OF SEWAGE TREATMENT FOR LOW FLOW AUGMENTATION.' THE RESULTS WERE PUBLISHED AS A THESIS WHICH WAS SUBMITTED TO THE GRADUATE SCHOOL OF THE UNIVERSITY OF FLORIDA IN AUGUST 1967. AS A COUNTERPART TO SEWAGE TREATMENT COSTS, GENERALIZED COST CURVES FOR IMPOUNDING WATER FOR FLOW AUGMENTATION ARE ESSENTIAL. MR A. PEREX, A CANDIDATE FOR THE M. S. E. DEGREE AND A GRADUATE RESEARCH ASSISTANT ON THE LOW FLOW PROJECT, IS UNDERTAKING A SMALL-SCALE SIMULATION WHICH WILL YIELD THE DESIRED INFORMATION. THE LAST THREE PHASES ARE CURRENTLY BEING PURSUED. (W68-00502).

00030. CONSERVATION OF POWER AND WATER RESOURCES: GRANTS FOR WATER POLLUTION CONTROL.

FEDERAL REGISTER, 31(94) 7114-7128, MAY 14, 1966.

RULES AND REGULATIONS DEALING WITH GRANTS FOR WATER POLLUTION CONTROL, MADE PURSUANT TO THE FEDERAL WATER POLLUTION CONTROL ACT, ARE SET FORTH IN PART 601. INCLUDED WITHIN THE SCOPE OF THE GRANTS ARE DEMONSTRATION PROJECTS FOR THE CONTROL OF DISCHARGES FROM STORMWATER OR COMBINED SEWER SYSTEMS, CONSTRUCTION OF TREATMENT WORKS, RESEARCH, TRAINING, AND AWARDS FOR RESEARCH FELLOWSHIPS. DETAILED RULES AND REGULATIONS FOR EACH OF THESE AREAS ARE GIVEN, INCLUDING FORMULAS FOR ALLOTMENTS TO STATES AND INTERSTATE WATER POLLUTION AGENCIES. PART 606 PRESENTS RULES AND REGULATIONS FOR PUBLIC HEARINGS HELD UNDER THE FEDERAL WATER POLLUTION ACT, COVERING AREAS FROM PUBLICATION OF NOTICE TO PARTIES TO EVIDENCE. (W68-00640).

00031. REGIONAL WATER QUALITY MANAGEMENT-A PILOT STUDY.

DAY, H.J.; DOLBEAR, F.T. JR.; KAMIEN, M.

PROC FIRST ANNU MEETING AMER WATER RESOURCES ASS, UNIV OF CHICAGO, 283-309, DEC. 1965.

A STUDY OF THE MINIMUM COST ATTAINMENT OF WATER QUALITY STANDARDS IN THE GREAT MIAMI RIVER BASIN IN OHIO WAS PRESENTED. A BRIEF DESCRIPTION OF THE HYDROLOGIC AND ECONOMIC ASPECTS OF THE BASIN WERE GIVEN. A MODIFIED STREETER-PHELPS OXYGEN SAG MODEL WAS USED IN CONSTRUCTING A LINEAR PROGRAMMING PROBLEM FOR MINIMIZING COSTS OF ACHIEVING QUALITY STANDARDS, GIVEN THE EXISTING TREATMENT FACILITIES. THE MODEL USED '0-1' PROGRAMMING TO ACCOUNT FOR THE FIXED CHARGE ASPECTS OF INSTALLING TREATMENT CAPACITIES, AND INTEGER PROGRAMMING TO ACCOUNT FOR LIMITED LEVELS OF ALLOWABLE TREATMENT. RESULTS FROM THIS PROBLEM, INCORPORATING DATA FROM THE MAIMI, WERE PRESENTED AND DISCUSSED. LONG RUN PRICING PROBLEMS WERE

REFERENCE LIST

OUTLINED AND POTENTIAL BASIN-WIDE TREATMENT TECHNIQUES WERE LISTED AND DISCUSSED. (W68-00870)

00032. THE POLLUTION CONTROL MODELS AND THEIR RESULTS.

SCHAUMBURG, JR., G.W.
WATER POLLUT CONTR IN THE DELAWARE ESTUARY, HARVARD WATER PROGRAM, CHAPT IV, 74-150, MAY 1967.

LINEAR PROGRAMMING MODELS WERE PRESENTED MINIMIZING THE COST OF SEVERAL TYPES OF WATER POLLUTION CONTROL SCHEMES FOR THE DELAWARE ESTUARY. THE FOLLOWING TYPES OF POLLUTION ABATEMENT SCHEMES WERE COMPARED: (1) REQUIRED TREATMENT (SECONDARY), (2) UNIFORM TREATMENT, (3) THE LEAST COST METHOD, (4) ZONED UNIFORM TREATMENT, (5) UNIFORM TREATMENT TAKING PAST REMOVALS INTO ACCOUNTS, AND (6) THE EFFLUENT CHARGE SYSTEM. METHODS (2), (3), (4), AND (6) WERE DIRECTLY COMPARED FOR SEVERAL LEVELS OF ESTUARY QUALITY (DO LEVEL). THE EQUITY CONSIDERATIONS OF ALL THE SCHEMES WERE DISCUSSED, AND TABLED FOR COMPARISON. (W68-00877)

00033. MATHEMATICAL MODEL FOR WATER POLLUTION CONTROL STUDIES.

GOODMAN, A.S.; DOBBINS, W.E.
AMER SOC CIVIL ENG PROC, 92(SA6) 1-19, DEC 1966.

A METHODOLOGY WAS PRESENTED FOR STUDYING THE PHYSICAL, ECONOMIC, AND ADMINISTRATIVE INTERRELATIONSHIPS OF WATER POLLUTION CONTROL PROGRAMS. IT FEATURED A MATHEMATICAL MODEL FOR A HYPOTHETICAL STRETCH OF RIVER. THE 'COMMUNITY AND RIVER MODEL' WAS CALLED CARM-1. A COMPUTER PROGRAM, WRITTEN IN FORTRAN II, CONTAINED EQUATIONS FOR RIVER CHARACTERISTICS (E. G. FLOW, TIME, BOD, DO) COMMUNITY CHARACTERISTICS (E. G. SUPPLIES, DEMANDS, COSTS, BENEFITS, DISCHARGES, BOD, DO, COLIFORMS). THE PROGRAM WAS COMPRISED OF THREE COMPONENTS: (1) STATEMENTS TO CONTROL DATA PROCESSING, (2) EQUATIONS FOR CARM, AND (3) STATEMENTS FOR AN 'OPTIMIZING ROUTINE'. THE INPUT SETS ASSUMED VARIOUS LEVELS OF TREATMENT AT 10 PERCENT INCREMENTS OF BOD REMOVED FOR THE VARIOUS PLANTS. RESULTS WERE GRAPHED FOR THE NINE SECTIONS OF RIVER STUDIED. THE OPTIMIZING ROUTINE, BASED ON THE 'PATH OF STEEPEST ACCENT', HAD SOME LIMITATIONS. MODIFICATIONS, SUCH AS ASSUMING PRIMARY TREATMENT AT ALL PLANTS, WERE RECOMMENDED. IT WAS CONCLUDED THAT BASIN COSTS CAN BE LOWERED IF UNIFORM TREATMENT IS NOT REQUIRED AT ALL PLANTS. (W68-00881)

00034. THE ECONOMICS OF WATER UTILIZATION IN THE BEET SUGAR INDUSTRY.

LOF, G.O.G.; KNEESE, A.V.
RESOURCES FOR THE FUTURE, JOHNS HOPKINS PRESS, BALTIMORE, 1968.

A SINGLE AVERAGE PLANT OF THE 58 PLANTS IN THE BEET SUGAR INDUSTRY PRODUCES GROSS WASTES EQUIVALENT TO RAW DOMESTIC SEWAGE FROM A POPULATION OF 270,000. THE ELIMINATION OF REMAINING WASTE FROM THE INDUSTRY WASTEWATER COULD BE ACCOMPLISHED AT A COST OF $5,000,000 ANNUALLY BY RECIRCULATION OF PROCESS WATER AND ITS ATTENDANT TREATMENT, PULP DRYING, MODERN METHODS OF PROCESSING 'STEFFENS WASTE' AND RE-USE OF 'CONDENSER WATER' AS WELL AS BY SPECIFIC WASTE TREATMENT PROCESSES. HOWEVER, THE INCREMENTAL COSTS OF REMOVING POLLUTION WOULD GRADUALLY INCREASE FROM $1 TO $90 PER UNIT REMOVED. THE AUTHORS MAKE THREE MAIN POINTS: (A) FURTHER RESEARCH IS NECESSARY TO ACHIEVE IMPROVED BIOLOGIC TREATMENT OF BEET SUGAR PLANT WASTES, (B) PROJECTIONS OF WATER AND WASTE LOADS WHICH ARE MADE BY APPLYING COEFFICIENTS BASED UPON PRESENT TECHNOLOGY TO PROJECTED INDUSTRIAL PRODUCTION ARE NOT RELIABLE, AND (C) ECONOMIC INCENTIVES OFFERED INDUSTRIAL FIRMS TO TREAT THEIR WASTES (AS BY TAX ABATEMENT) MAY LEAD TO GROSSLY INEFFICIENT RESOURCE UTILIZATION, SINCE PROCESS CHANGE MAY BE A BETTER WAY OF HANDLING THE PROBLEM. THE LATTER TWO POINTS ARE OF GENERAL APPLICATION IN THE FIELD OF INDUSTRIAL WASTE TREATMENT. (W68-00883)

00035. SOME RELATIONSHIPS BETWEEN WATER POLLUTION AND INDUSTRIAL DEVELOPMENT IN SOUTH CAROLINA.

STEPP, J.M.
COMPLETION REPORT, OWRR PROJECT NO. A-002-SC, AUGUST 1968.

THERE WERE FOUR SEPARABLE PARTS OF THIS RESEARCH PROJECT: (1) COMPILATION OF DATA ON WATER SUPPLY AND UTILIZATION, AMOUNT AND STRENGTH OF EFFLUENT, WASTEWATER DISPOSAL AND TREATMENT, EMPLOYMENT, AND LOCAL TAXES PAID TO 135 WET-PROCESS SOUTH CAROLINA MANUFACTURING PLANTS. (2) STUDY OF INDUSTRIAL WASTEWATER TREATMENT COSTS IN SOUTH CAROLINA BY APPLYING HYDROLOGICAL, ENGINEERING AND ECONOMIC PRINCIPLES TO READILY-AVAILABLE DATA. (3) AN ENGINEERING-ECONOMIC ANALYSIS OF ALTERNATIVE METHODS AND COSTS OF DISPOSING OF PEACH CANNING WASTES. (4) A MAIL SURVEY OF INDUSTRIAL WASTE TREATMENT BY SOUTH CAROLINA MUNICIPALITIES. IN TERMS OF TOTAL VOLUME OF WASTEWATER, BOD AND SUSPENDED SOLIDS, THE TEXTILE INDUSTRY IS THE GREATEST INDUSTRIAL POLLUTOR OF SOUTH CAROLINA'S WATERS, BUT THE PAPER INDUSTRY HAS A HIGHER LEVEL OF POLLUTION PER WORKER EMPLOYED AND PER DOLLAR OF LOCAL TAXES PAID. THE STUDY OF PEACH CANNERIES INDICATED THAT THE LEAST-COST SYSTEM OF WASTE DISPOSAL UNDER MOST OF THE CONDITIONS ANALYZED WAS SPRAY IRRIGATION OF VEGETATION-COVERED LAND. (W68-00895)

00036. A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT.

JOHNSON, E.L.
WATER RESOURCES RESEARCH, 3(2) 291-305, SECOND QUARTER 1967.

LINEAR PROGRAMMING TECHNIQUES WERE USED TO COMPARE FOUR METHODS OF ALLOCATING WASTE REDUCTIONS AMONG DISCHARGERS. REDUCTION WAS REQUIRED TO ATTAIN VARIOUS DO STANDARDS FOR THE DELAWARE ESTUARY. THE FOUR METHODS COMPARED WERE: (1) UNIFORM TREATMENT (UT) FOR ALL DISCHARGERS, (2) LEAST COST (LC) BASED ON MARGINAL COSTS OF TREATING, (3) SINGLE EFFLUENT CHARGE (SECH) TO ALL DISCHARGERS IN THE ESTUARY, AND (4) ZONE EFFLUENT CHARGE (ZECH) VARYING WITH GEOGRAPHIC LOCATION. THE RESULTS INDICATED THAT THE EFFLUENT CHARGE SCHEMES WERE CAPABLE OF ACHIEVING IMPROVEMENTS AT A COST APPROACHING THAT OF THE LEAST COST PLAN. THE IMPACT ON THE REGIONAL ECONOMY WAS NOT EXPECTED TO BE SIGNIFICANTLY DIFFERENT UNDER ANY OF THE SCHEMES STUDIED. HOW-

EVER, THE EFFICIENCY AND EQUITY CHARACTERISTICS OF THE EFFLUENT CHARGE TECHNIQUES APPEARED SUPERIOR TO THOSE OF MORE CONVENTIONAL TECHNIQUES. IT WAS CONCLUDED THAT ADDITIONAL STUDIES IN THE APPLICATION OF EFFLUENT CHARGES WERE NEEDED, TO COPE WITH DIFFERENTIAL CHARGES RELATING TO DYNAMIC WASTE DISCHARGE SITUATIONS, TO DESCRIBE DISCHARGER RESPONSE MORE FULLY, AND TO DEFINE ADMINISTRATIVE PROBLEMS AND COSTS. (W68-01165).

00037. FACTORS IN THE DESIGN OF AN ACID MINE DRAINAGE TREATMENT PLANT.

HOLLAND, C.T., CORSARO, J.L., LADISH, D.J.
REPRINTS OF PAP 2D SYMP ON COAL MINE DRAINAGE RES, MELLON INST, 274-290 MAY 1968.

A PILOT PLANT WAS DESIGNED, BUILT AND OPERATED TO ESTIMATE THE COST OF TREATIG ACID MINE DRAINAGE TO MEET STANDARDS OF THE WEST VIRGINIA STATE WATER BOARD. FACTORS INVESTIGATED IN THE TREATMENT OF ACID MINE DRAINAGE ARE INTRODUCTION OF THE FEED WATER TO THE PLANT, NEUTRALIZATION, OXIDATION, SLUDGE SETTLING, SLUDGE HANDLING AND DISPOSAL, LAND REQUIREMENTS, AND COSTS. A FLOW SHEET ILLUSTRATES PLANT LAYOUT AND THE STAGE AT WHICH VARIOUS OPERATIONS ARE CARRIED OUT. OPERATING EXPENSES OF A PLANT DESIGNED TO TREAT 8,100,000 GPD OF HIGHLY ACID MINE WATER ARE ESTIMATED TO BE 47.5 CeNTS PER 1000 GALLONS, AND FOR WEAKLY ACID WATER, 18.90 CENTS PER 1000 GALLONS. (W69-00334).

00038. WATER SUPPLY AND POLLUTION CONTROL ASPECTS OF URBANIZATION.

BRYAN, E.H.
LAW AND CONTEMP PROB, 30(1), 176-192, WINTER 1965.

THE NEED TO DEVELOP NEW TECHNICAL APPROACHES AND SUITABLE LEGAL AND POLITICAL STRUCTURES FOR THE CONTROL OF POLLUTION ON A REGIONAL BASIS ARE DISCUSSED FROM A CIVIL ENGINEERING VIEWPOINT. WATER SUPPLY AND POLLUTION ARE PROPERLY APPROACHED AS ASPECTS OF A SINGLE PROBLEM. WATER RESOURCES IN TERMS OF QUANTITY ARE EXHAUSTIBLE PROVIDED THE QUALITY OF WASTEWATER IS SUFFICIENTLY IMPROVED PRIOR TO ITS RETURN TO LAKES AND STREAMS THUS KEEPING WATERWAYS IN SATISFACTORY CONDITION AND ENABLING DOWNSTREAM USERS TO WITHDRAW WATER OF USABLE QUALITY. WATER AS A TRANSPORT MEDIUM FOR WASTES IS AN IMPORTANT FUNCTION IN COMMUNITY SYSTEMS. WATER POLLUTION RESEARCH STILL IS BUT 'A DROP IN THE BUCKET'. COSTS ARE THE GREATEST OBSTACLE TO EFFECTIVE POLLUTION CONTROL. URBANIZED AMERICA MUST HAVE TECHNICALLY SOUND WATER MANAGEMENT. INCLUDED TABLES ILLUSTRATE THE EXTENT OF INDUSTRIAL WATER CONSUMPTION AND THE SHIFT OF POPULATION IN FLORIDA FROM RURAL TO URBAN AREAS. (W69-00290).

00039. ECONOMICS OF WATER POLLUTION.

BINIEK, J.P., TAYLOR, G.C.
FLORIDA UNIV., INSTITUTE OF FOOD AND AGRI SCI, WATER RESEARCH NEEDS: AN ECONOMIC APPRAISAL, PUBLICATION NO. 3, 57-70, DEC 1967.

WATER QUALITY IS A SUBSET OF THE LARGER FIELD OF ENVIRONMENTAL QUALTIY. THERE IS A DIRECT INTERRELATIONSHIP BETWEEN POLLUTED AIR, SOIL, AND WATER. WATER IS AN ECONOMIC PROBLEM SINCE IT IS CHARACTERIZED BY DIMENSIONS OF DEMAND, SUPPLY, LOCATION, TIME, AND QUALITY. WATER POLLUTION IS DEFINED AS AN UNDESIRABLE CHANGE IN THE RELEVANT CHARACTERISTICS OF A WATER SUPPLY. A CLASSIFICATION OF THE ORIGIN OF POLLUTANTS WAS LISTED. THE COSTS AND BENEFITS OF WATER POLLUTION ARE INFLICTED BY ONE DECISION MAKING UNIT AND BORNE BY ANOTHER WITHOUT ANY PRICE SIGNALS BEING REGISTERED IN THE NORMAL MARKET PRICE STRUCTURE. HENCE, DISADVANTAGED PARTIES RESULT AND THEY TRY TO SOLVE THE PROBLEM POLITICALLY. THE WEIGHING OF BENEFITS AND COSTS TO AFFECTED PARTIES AND THE DESIGN OF OPTIMIZING SOLUTIONS THROUGH VARIOUS PROGRAMS, PUBLIC AND PRIVATE, ARE THE ECONOMIC CONTENT OF THE POLITICAL PROBLEM OF WATER POLLUTION. FOUR MAJOR KINDS OF ECONOMIC RESEARCH APPEAR TO BE NEEDED IN THE WATER POLLUTION AREA. THESE INCLUDE ECONOMIC SURVEYS, ANALYSES OF CRITICAL PROBLEMS, STUDIES OF INSTITUTIONS, AND RESEARCH TO IMPROVE THE ANALYTICAL ABILITIES OF RESEARCHERS. A PARTIAL LIST OF SOURCES OF RESEARCH DATA WAS GIVEN. (W69-00172).

00040. THE ECONOMICS OF REGIONAL WATER QUALITY MANAGMENT: WATER POLLUTION AND RESOURCES ALLOCATION BY PRIVATE MARKETS.

KNEESE, A.V.
JOHNS HOPKINS PRESS, BALTIMORE, 38-53, 1964.

MOST ECONOMISTS CONSIDER THE MARKET SYSTEM AS AN EFFICIENT DEVICE FOR ALLOCATING RESOURCES PURSUANT TO CONSUMER WANTS. WATER POLLUTION IS A CLASSIC EXAMPLE OF TECHNOGOLICAL EXTERNAL DISECONOMY. ONE KEY TO THE POLLUTION PROBLEM IS THE FAILURE OF MUNICIPAL AND INDUSTRIAL WASTE DISCHARGERS TO CONSIDER THAT SUBSEQUENT WATER USES MAY BE MADE MORE EXPENSIVE OR FORECLOSED ENTIRELY BY THE DISCHARGE. THE RESULTS ARE HIGHER COSTS OF TREATMENT AND INCREASING WASTES. THERE IS A CLOSE RELATION BETWEEN THE NATURE OF PROPERTY RIGHTS AND THE OCCURENCE OF EXTERNAL DISECONOMIES. PROPERTY RIGHTS SHOULD BE STRUCTURED SUCH THAT UPSTREAM POLLUTERS WILL TAKE INTO ACCOUNT DOWNSTREAM COSTS. LEGAL REMEDIES ARE INADEQUATE IN SEVERAL RESPECTS. THE POSSIBILITY OF INTERNALIZING THE EXTERNALITIES INTO A PRIVATE DECISION MAKING UNIT OVER AN ENTIRE BASIN IS DISCUSSED. THE RELATIONSHIP OF UPSTREAM DISCHARGES AND DOWNSTREAM DAMAGES IS ALSO DISCUSSED. DOWNSTREAM COSTS MUST BE MEASURED AGAINST UPSTREAM REDUCTION. CONSIDERATION OF WATER SHORTAGES INVOLVE THE SAME PRINCIPLES. THE MARKET PLACE AND JUDICIAL SYSTEM DO NOT AUTOMATICALLY RESULT IN REALIZATION OF DOWNSTREAM DAMAGES. (W69-00286).

00041. TODAY'S PROBLEMS OF INDUSTRIAL WASTE WATER POLLUTION ABATEMENT.

NEBOLSINE, R.
NATURAL RESOURCES LAWYER, 1(1), 39-57 1968.

THE ARTICLE DEALS WITH THE INDUSTRIAL WASTE PROBLEMS IN RELATION TO POLLUTION PROBLEMS FROM OTHER SOURCES. REMEDIES AND METHODS OF ACHIEVING THEM ARE OUTLINED. THE AUTHOR CONSIDERS WATER QUALITY STANDARDS, THE COSTS OF POLLUTION ABATEMENT TO INDUSTRIES, A PROGRAM FOR POLLUTION ABATEMENT, AND THE MEANS FOR ENCOURAGING INDUSTRIES TO COMPLY. HE ATTEMPTS TO PREDICT WHAT FUTURE DEVELOPMENTS WILL CONCERN THE AREA. THROUGH THE COMBINED EFFORTS OF INDUSTRY AND GOVERNMENT THE PROBLEMS CAN BE LARGLY SOLVED WITHIN THE NEXT FEW YEARS. (W69-00328).

REFERENCE LIST

00042. SENSITIVITY ANALYSIS OF ACTIVATED SLUDGE ECONOMICS.

MCBEATH, B.C.; ELIASSEN, R.
ASCE PROCEEDINGS, 92(SA2), 147-167, 1966.

THE SENSITIVITY OF COSTS OF AN ACTIVATED SLUDGE TREATMENT SYSTEM TO SOME OF THE PARAMETERS USED IN ITS DESIGN WAS TESTED. THE ACTIVATED SLUDGE PROCESS WAS DESCRIBED IN TERMS OF THE EFFECTS OF WASTE CHARACTER TREATMENT RATES AND CONSTRUCTION AND OPERATIONAL COSTS. THE SENSITIVITY ANALYSIS WAS PERFORMED ON A COMPUTER USING FIRST A SUBSTITUTION OF VALUES METHOD AND THEN A GRAPHIC DISPLAY OF COST RESPONSE TO PARAMETER CHANGES FOR PARAMETERS IDENTIFIED AS CRITICAL. IT WAS CONCLUDED THAT THE PROCEDURE OFFERED A MEANS OF PARAMETRIC STUDY FOR THE PURPOSE OF DESCRIBING SOME OPTIMAL CHARACTERISTICS OF THE SYSTEM, AS WELL AS SOME MEANS OF IDENTIFYING THOSE CHARACTERISTICS. HOWEVER, IT WAS STATED THAT THE PROCEDURE GAVE OPTIMAL SOLUTIONS ONLY WHEN THE APPROPRIATE PARAMETERS WERE EXAMINED WITHIN THE PROPER LIMITS. (W69-00352).

00043. ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL.

BAXTER, S.S.
J WATER POLLUTION CONTROL FED., 37(10), 1363-1369, 1965.

WATER POLLUTION CONTROL EXPENDITURES SHOULD BE JUSTIFIED ON THE BASIS OF A FAVORABLE BENEFIT-COST RATIO. THE AUTHOR CONSIDERS THE FOLLOWING FOUR TOPICS WITH RESPECT TO POLLUTION-CONTROL EXPENDITURES: (1) THE PURPOSES AND USES EXPECTED OF RECEIVING STREAMS. (2) THE ACTUAL BENEFITS AND IMPROVEMENTS DERIVED FROM THE STREAM IF A HIGHER DEGREE OF TREATMENT IS USED. (3) THE RELATION BETWEEN THE COSTS AND BENEFITS FROM DIFFERENT DEGREES OF TREATMENT. (4) THE RELATION OF THE COSTS AND BENEFITS OF POLLUTION CONTROL TO THE COSTS AND BENEFITS OF OTHER CIVIC PROGRAMS. (W69-03613).

00044. A LEAST COST EVALUATION OF DISPOSAL SYSTEMS FOR LOW LEVEL LIQUID RADIOACTIVE WASTES.

SPOFFORD, W.O.; THOMAS, JR., H.A.
OPER RES DISPOSAL LIQUID RADIOACTIVE WASTES IN STREAM, HARVARD WATER RESOURCES GROUP, PART 2 DEC. 1967.

LAGRANGE MULTIPLIERS WERE USED IN THE ANALYSIS OF A SIMPLIED WASTE HANDLING AND TREATMENT SCHEME ON STREAM. DETERMINING STEADY STATE STREAM FLOWS WERE ASSUMED. THE OBJECTIVE WAS TO MINIMIZE THE SUM OF THE COSTS AT AN UPSTREAM WASTE TREATMENT PLANT AND A DOWNSTREAM WATER TREATMENT PLANT. THE WATER QUALITY PRODUCED BY WATER TREATMENT PLANT WAS CONSTRAINED TO BE GREATER THAN SOME VALUE. THE DECISION VARIABLES WERE THE VARIOUS COMBINATIONS OF EFFICIENCY FOR EACH OF THE PLANTS, AND THE STATE VARIABLES WERE THE PHYSICAL AND HYDROLOGIC PARAMETERS. TWO EXAMPLES, WITH AND WITHOUT ASSUMED RESERVOIR STORAGE, ILLUSTRATED THE USE OF THE MODEL. IMPORTANT CONCEPTS OF SYSTEMS ANALYSIS SUCH AS : (1) OPTIMAL ECONOMIC DESIGN; (2) PROBLEM IDENTIFICATION; (3) ERROR ANALYSIS, AND (4) OPTIMAL ALLOCATION OF FUNDS FOR FUTURE DATA COLLECTION WERE ILLUSTRATED AND DISCUSSED. ONE OF FIVE CHAPTERS IN 'OPERATIONS RESEARCH IN DISPOSAL OF LIQUID RADIOACTIVE WASTES IN STREAMS.' (W69-00356).

00045. PLANNING A WATER QUALITY MANAGEMENT SYSTEM: THE CASE OF THE POTOMAC ESTUARY.

DAVIS, R.K.
WATER RESEARCH, 99-121, JOHNS HOPKINS PRESS, BALTIMORE, 1966.

THE AUTHOR DESCRIBES A STUDY OF THE COST OF ALTERNATIVE SYSTEMS FOR DISSOLVED OXYGEN MANAGEMENT IN THE POTOMAC ESTUARY BEING CONDUCTED BY RESOURCES FOR THE FUTURE, INC. HE EXPLAINS THE THEORETICAL BASIS AND STRATEGY OF THE STUDY AND PRESENTS PRELIMINARY COST ESTIMATES OF ACHIEVING A SPECIFIED GOAL FOR DISSOLVED OXYGEN BY A NUMBER OF ALTERNATIVE METHODS. (W69-03643).

00046. THE LAKE TAHOE WATER RECLAMATION PLANT.

CULP, R.L.; RODERICK. R.E.
J WATER POLLUTION CONTROL FED., 38(2), 19669.

THE AUTHORS DESCRIBE THE NEW TERTIARY SEWAGE TREATMENT PLANT OF SOUTH TAHOE PUBLIC UTILITY DISTRICT WHICH PRODUCES A HIGH QUALITY, COLORLESS, ODORLESS EFFLUENT. THE ARTICLE PRESENTS CONSTRUCTION AND OPERATING COSTS ESTIMATES FOR PLANTS OF 2.5,10.0,50.0,100.0, AND 200.0 MGD CAPACITY, AND FOR VARYING DEGREES OF TREATMENT. A PRINCIPAL CONCLUSION IS THAT THE COST OF PROVIDING THE MAXIMUM QUALITY TERTIARY TREATMENT WITH THIS PROCESS WOULD VARY FROM 24 CENTS TO 37 CENTS/CAP/MONTH, DEPENDING ON THE SIZE OF THE TREATMENT PLANT. THIS ESTIMATED COST IS BASED UPON AN AVERAGE ESTIMATED EFFLUENT VOLUME 100 GPD PER CAPITA. THE AUTHORS ALSO CONCLUDE THAT 'TERTIARY TREATMENT PROVIDES AN ECONOMIC ADVANTAGE OVER DESALINATION AS A SOURCE OF WATER, SINCE WASTEWATER CAN BE RENOVATED FOR ONLY 10-15 PERCENT OF THE LATEST REALISTIC ESTIMATES OF COST FOR DESALINATION'. (W69-03640).

00047. DELAWARE ESTUARY COMPREHENSIVE STUDY-PRELIMINARY REPORT AND FINDINGS.

REPORT, FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, DEPARTMENT OF THE INTERIOR, WASHINGTON, D. C. JUNE 29, 1966.

THE RESULTS OF THE DELAWARE ESTUARY COMPREHENSIVE STUDY WERE PRESENTED. THE HISTORY OF THE POLLUTION PROBLEM AND A PHYSICAL DESCRIPTION OF THE WATER QUALITY AND WATER DEMAND REQUIREMENTS OF THE ESTUARY WERE GIVEN. FIVE QUALITY OBJECTIVE SETS OF THE STUDY WERE PRESENTED, RANGING FROM THE HIGHEST QUALITY (SET I) TO THE MAINTENANCE OF THE PRESENT QUALITY LEVEL (SET V). FOUR WASTE REDUCTION SCHEMES WERE EVALUATED. THEY WERE (1) UNIFORM TREATMENT FOR ALL SOURCES; (2) EQUAL WASTE REDUCTION BY ZONES. (3) EQUAL WASTE REDUCTION BY INDUSTRIAL OR MUNICIPAL CATEGORIES, AND (4) A TOTAL MINIMUM COST SCHEME. OTHER ALTERNATIVES SUCH AS WASTE PIPING, FLOW REGULATION AND INSTREAM AERATION WERE EVALUATED. A COMPUTER SIMULATION MODEL WAS USED TO FORECAST THE TIME VARYING DO PROFILES FOR VARIOUS FLOW CODITIONS AND OXYGEN DEMANDING LOADS. RESULTS OF THE STUDY ARE SHOWN IN FIGURES AND TABLES. THE REPORT RECOMMENDED INTERMEDIATE OBJECTIVE SET III AS THE POLICY OBJECTIVE FOR THE ESTUARY. (W68-01167).

00048. SOME ECONOMIC ASPECTS OF ADVANCED WASTE TREATMENT.

DAVIS. R.K.

J WATER POLLUTION CONTROL FED., 7(12), 1617-1628, 1965.

RESEARCH AIMED AT ACHIEVING LEAST COST SYSTEMS OF OBTAINING A GIVEN WATER QUALITY CONTROL OBJECTIVE IN THE POTOMAC ESTUARY IS DISCUSSED. BASIC ECONOMIC CONCEPTS INVOLVED IN DETERMING TRADE OFFS BETWEEN FLOW AUGMENTATION AND WASTE TREATMENT ARE PRESENTED. ONE PRINCIPAL CONCLUSION IS THAT HIGHER LEVELS OF WASTE TREATMENT, TOGETHER WITH LOW-FLOW AUGMENTATION, APPEAR TO HAVE A PLACE IN THE SOLUTION OF WATER QUALITY MANAGEMENT PROBLEMS OF THE SORT REPRESENTED BY THIS ILLUSTRATIVE CASE. THE STUDY'S VIEW OF THE WASTE TREATMENT PROCESS IS UNCONVENTIONAL IN NATURE, IN THAT IT FINDS DISCONTINUOUS OPERATION OF CERTAIN PROCESSES IN THE PLANT AND POSSIBLY MORE THAN ONE LEVEL OF INTENSITY OF OPERATION AS DESIRABLE. THE REASONS FOR THIS ARE SUBSTANTIAL DIFFERENCES IN CAPITAL COSTS AND OERATING COSTS AMONG THE VARIOUS PROCESSES. THE FIRST CONCERNS THE ADVANTAGES OF SUBSTITUTING OPERATING COSTS FOR CAPITAL COSTS, SUCH AS MIGHT BE DONE IN A CHOICE BETWEEN CHEMICAL PRECIPITATION AND ADDITIONAL AERATION CAPACITY FOR THE ADVANCED TREATMENT. FOR SANITARY ENGINEERS, THE STUDY STATES THE CONCLUSION OF INTEREST IS FIRST IN THE DESIGN OF TREATMENT PROCESSES TO RESPOND TO VARIATIONS IN POLLUTION CONDITIONS. THERE NEEDS TO BE GREAT WEIGHT ATTACHED TO THE ADVANTAGES OF PROCESSES WHICH INCUR RELATIVELY HIGH OPERATING COSTS AND RELATIVELY LOW CAPITAL COSTS. COST DATA ARE PRESENTED TO SUPPORT THESE CONCLUSIONS. (W69-03644).

00049. REGIONAL CONSTRUCTION REQUIREMENTS FOR WATER AND WASTEWATER FACILITIES 1955-1967.

KOLLAR, K.L.; VOLONTE, A.F.

US DEPARTMENT OF COMMERCE, BUSINESS AND DEFENSE SERVICES ADMINISTRATION, OCT 1967. 35 P.

THIS DEPARTMENT OF COMMERCE STUDY PROVIDES HISTORICAL CONSTRUCTION-COST DATA FROM 1955 TO 1966 AND A PROJECTION OF REQUIREMENTS FROM 1967 TO 1980. POPULATION PROJECTIONS AND WASTEWATER INVESTMENT REQUIREMENTS BY MAJOR CENSUS REGIONS ARE GIVENS. A BREAKDOWN BY INVESTMENT REQUIREMENTS OF COLLECTION SYSTEMS, TREATMENT PLANTS, AND TREATMENT PLANT EQUIPMENT IS INCLUDED. (W69-03698).

00050. MATHEMATICAL MODEL FOR DETERMINING THE OPTIMAL SIZES OF WATER TREATMENT PLANTS.

OPERATIONS RESEARCH IN WATER QUALITY MANAGEMENT, PP 5-1 TO 5-21, FEBRUARY 1963.

A DECISION THEORY MODEL WAS PRESENTED WHICH INDICATED THE PROPER SIZE OF A WATER TREATMENT PLANT TO BE DEVELOPED. THE PROBLEM REQUIRED THE BALANCING OF ECONOMIES OF SCALE IN PRESENT CONSTRUCTION AGAINST THE DISECONOMY OF UNPROFITABLE INVESTMENT IN EXCESS CAPACITY NOT NEEDED FOR SEVERAL YEARS. THE PLANT SIZE THAT MAXIMIZED ECONOMIC EFFICIENCY WAS EXPRESSED AS A FUNCTION OF POPULATION GROWTH RATE, PER CAPITA DEMAND FOR WATER, THE INTEREST RATE OF CAPITAL INVESTMENT, AND THE ECONOMIC TIME HORIZON. MUNICIPAL WATER REQUIREMENTS WERE NOT TREATED AS RIGID CONSTRAINTS. INSTEAD, A LOSS FUNCTION WHICH ASSIGNED ECONOMIC PENALTIES TO SMALL OR MEDIUM SIZED WATER SHORTAGES WAS USED. A HYPOTHETICAL EXAMPLE ILLUSTRATED THE USE OF THE MODEL. ONE OF SEVEN CHAPTERS IN 'OPERATIONS RESEARCH IN WATER MANANGEMENT'. (W69-01213).

00051. RESEARCH PROBLEMS IN WATER QUALITY AND RECREATION.

EATON, E.D.

CONFERENCE ON WATER QUALITY AND RECREATION IN OHIO, WATER RESOURCES CENTER, THE OHIO STATE UNIVERSITY, COLUMBUS, OHIO, JUNE 15, 1966.

ABOUT $107 MILLION WAS BUDGETED FOR WATER RESOURCES RESEARCH FOR THE 1967-68 FISCAL YEAR. THERE WERE TWO DIRECTIONS BEING PURSUED IN RESEARCH IN WATER QUALITY MANAGEMENT: (1) TO DECREASE THE AMOUNT AND POTENCY OF POLLUTION REACHING STREAM CHANNELS, AND (2) TO HANDLE WASTE STREAMS AND RECEIVING WATERS SO AS TO MINIMIZE DELETERIOUS EFFECTS. COST-BENEFIT EVALUATIONS OF RECREATION PROGRAMS ARE MORE DIFFICULT TO MAINTAIN THAN AN EVALUATION OF THE BENEFITS OF WATER QUALITY MANAGEMENT. THERE ARE MANY PROBLEMS INVOLVED IN SUCH AN ATTEMPTED EVALUATION. (W69-03653).

00052. A STUDY IN THE ECONOMICS OF WATER QUALITY MANAGEMENT.

JOHNSON, E.L.

WATER RESOURCES RESEARCH, 3(2), 291-305, SECOND QUARTER 1967.

THE STUDY ATTEMPTS TO ESTIMATE THE CHARGE REQUIRED TO ATTAIN SPECIFIC LEVELS OF WATER QUALITY, INVESTIGATE THE RELATION OF THE CHARGE LEVEL TO INDUSTRIAL OUTPUT, AND COMPARE THE EFFLUENT CHARGE METHOD WITH OTHER METHODS OF POLLUTION CONTROL. THE PHYSICAL MODEL EMPLOYED IS A LINEAR STEADY-STATE VERSION OF A DYNAMIC WASTE SYSTEM DEVELOPED IN THE DELAWARE ESTUARY STUDY. INPUT DATA CONSISTS OF A MATRIX RELATING THE EFFECT ON (DO) LEVEL IN EACH REACH TO A UNIT REMOVAL OF OXYGEN-DEMANDING MATERIAL IN ANOTHER REACH AND A PIECEWISE LINEAR COST FUNCTION SHOWING THE WASTE REMOVAL COST OF EACH DISCHARGER. THE FINDINGS OF THE STUDY INDICATE THAT EFFLUENT CHARGES SHOULD BE CONSIDERED AS A METHOD OF IMPROVING WATER QUALITY AND THAT OF WASTE TREATMENT USING THE EFFLUENT CHARGE METHOD IS APPROACHING THE LEAST COSTLY TREATMENT PLAN. THE STUDY DOES NOT FIND EVIDENCE FOR REGIONAL ECONOMIC EFFECTS FROM THE CHARGE LEVEL. THE CHARGE METHOD IS PREFERRED TO CONVENTIONAL METHODS BECAUSE IT ATTAINS THE SAME GOAL AT LOWER COST, IS MORE EQUITABLE AND EFFECTIVE AND PROVIDES A GUIDE TO PUBLIC INVESTMENT DECISIONS. FURTHER STUDY IS NEEDED IN PROBLEMS OF DIFFERENTIAL CHARGES, PREDICTION OF INDUCED RESPONSES, AND ADMINISTRATIVE PERFORMANCE AND COST. (W69-03173).

REFERENCE LIST

00053. HANDBOOK OF POLLUTION CONTROL COSTS IN MINE DRAINAGE MANAGEMENT.

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, DEC 1966. 54 P.

THE INFORMATION PRESENTED IN THIS PUBLICATION ANSWERS A NEED OF THE MONONGAHELA RIVER MINE DRAINAGE REMEDIAL PROJECT FOR PRELIMINARY COST DATA IN DETERMINING RELATIVE COSTS OF MINE DRAINAGE ABATEMENT. COSTS OF REMEDIAL MEASURES ARE LISTED AND EVALUATED ON A UNIT PRICE BASIS. THEY COVER A PERIOD OF 33 YEARS FROM 1933 TO THE PRESENT TIME. THESE INCLUDE UNIT COSTS ON SUCH ITEMS AS MINE SEALS OR BULKHEADS, SURFACE RECLAMATION OF STRIP-MINES ALONG WITH ASSOCIATED PLANTING, RECLAMATION OF REFUSE AREAS, DRAINAGE DIVERSION AND IMPOUNDMENT, AND TREATMENT OF MINE DRAINAGE. METHODS EXAMINED ARE GROUPED INTO DEALING WITH UNDERGROUND MINE DRAINAGE, SURFACE MINE DRAINAGE, DRAINAGE FROM REFUSE AND WASTE DISPOSAL AREAS, ANDCONTROL AND TREATMENT OF WATER IN ACTIVE MINING SITUATIONS. (W69-01236)

00054. CORRECTING STORM-WATER INFILTRATION, TONAWANDA, NEW YORK.

NUSSBAUMER, N.L.
SEWAGE AND INDUSTRIAL WASTES, 28 977-82, 1956.

THE ARTICLE DESCRIBES THE LAYOUT AND CONSTRUCTION OF THE EARLY SEWERS IN TONAWANDA, N. Y. IMPROPER PLANNING, POOR CONSTRUCTION, LACK OF STORM SEWERS, AND THE DIVERSION OF SURFACE WATER INTO THE SANITARY SEWERS CAUSED FLOODING OF THE SANITARY SEWERS DURING PERIODS OF PRECIPITATION. INCREASED TRIBUTARY POPULATION INTENSIFIED SEWER PROBLEMS. SEVERAL ATTEMPTS WERE MADE TO REMEDY THE SITUATION. IN 1945 A COMPREHENSIVE STORM DRAIN PLAN WAS DEVELOPED TO ELIMINATE THE EXCESS WATER FROM THE SANITARY SEWERS. THE TYPES OF STORM SEWERS USED, DESIGN CRITERIA, CONSTRUCTION DETAILS, AND COSTS ARE OUTLINED. (W69-02165)

00055. STANDARDS, CHARGES, AND EQUITY.

KNEESE, A.V., BOWER, B.T.
MANAGING WATER QUALITY: ECONOMICS, TECHNOLOGY, INSTITUTIONS, BALTIMORE: JOHNS HOPKINS PRESS, 1968, CHAP. 7, P 131-142.

POSSIBLE STANDARDS FOR WATER QUALITY IN STREAMS, LAKES, AND ESTUARIES ARE DISCUSSED. 'COMPLEMENTARITIES' IN TREATMENT OR OTHER MEASURES FOR REDUCTION OF WASTE DISCHARGES ARE REVIEWED WITH CONSIDERATION OF EFFLUENT STANDARDS. THE EFFLUENT CHARGE CAN BE USED TO ACHIEVE STREAM WATER QUALITY STANDARDS EFFICIENTY, I. E. AT LOWEST ECONOMIC OR RESOURCE COST. EACH WASTE DISCHARGER IS CHARGED IN PROPORTION TO THE USE HE MAKES OF A RESOURCE- THE WASTE ASSIMILATIVE AND TRANSPORT CAPACITY OF THE WATERCOURSE. THE WASTE DISCHARGER CAN COMPARE HIS MARGINAL COSTS AND MARGINAL CHARGES AND DECIDE WHETHER IT PAYS HIM TO REDUCE HIS WASTE AND TO WHAT DEGREE. THE REVENUE THAT ACCRUES TO THE AGENCY FROM THE CHARGES CAN BE VIEWED AS A RENTAL RETURN ON A NATURAL RESOURCE. IDEALLY, CHARGES SHOULD BE LEVIED ON ALL ACTIVITIES WHICH REDUCE WATER QUALITY SUFFICIENTYLY TO IMPOSE EXTERNAL COSTS, BUT THIS MAY NOT BE ADMINISTRATIVELY FEASIBLE. A DISCUSSION OF THE EQUITY OF CHARGES WHICH FOCUSES ON THE DISTRIBUTION OF COSTS OF WATER QUALITY MANAGEMENT IS PRESENTED. (W69-01402)

00056. BENEFIT-COST ANALYSIS AND WATER POLLUTION CONTROL.

HAMMOND, R. J.
FOOD RESEARCH INSTITUTE, STANFORD UNIVERSITY, STANFORD CALIFORNIA, MISCELLANEOUS PUBLICATION 13, 1960.

THIS REPORT PRESENTS THE AUTHOR'S OPINIONS REGARDING BENEFIT-COST ANALYSIS AS APPLIED TO WATER POLLUTION CONTROL. THE REPORT DELVES INTO THE HISTORY OF BENEFIT-COST ANALYSIS AND PRESENTS A GENERAL DISCUSSION ON ITS USE FOR THE ANALYSIS OF WATER RESOURCE INVESTMENT. THE AUTHOR IS, IN GENERAL, PESSIMISTIC ABOUT THE VALUE OF BENEFIT-COST TECHNIQUES IN RELATION TO WATER QUALITY CONTROL. AN EXCELLENT BIBLIOGRAPHY IS INCLUDED IN THE REPORT. (W69-04998)

00057. ECONOMICS OF WATER QUALITY MANAGEMENT.

TIMMONS, J.F.; DOUGAL, M.D.
INTERNATIONAL CONFERENCE ON WATER FOR PEACE, VOL 6, PP 667-678, 1968.

THE MAJOR PURPOSE OF THIS PAPER IS TO IDENTIFY ARTICULATE WATER QUALITY PROBLEMS WITHIN AN ECONOMIC FRAMEWORK FOR (1) MAXIMIZING THE SATISFACTION OF HUMAN WANTS FROM THE USE OF WATER AND (2) MINIMIZING THE COSTS OF PRODUCING THESE SATISFACTIONS, CONSIDERING BOTH THE DIRECT AND DERIVED DEMANDS FOR WATER, INCLUDING THE GOODS AND SERVICES WATER HELPS PRODUCE. A SECOND PURPOSE IS TO ELABORATE AN ECONOMIC FRAMEWORK WITHIN WHICH WATER QUALITY PROBLEMS FACING OUR STATES AND NATION MAY BE ANALYZED. IN PURSUING THESE OBJECTIVES, THE PAPER JOURNEYS INTO THE NATURE OF AND THE GROWING DEMAND FOR WATER, THE ECONOMIC DIMENSION OF WATER QUALITY PROBLEMS IN RELATION TO PHYSICAL AND STRUCTURAL DIMENSIONS, SUPPLY AND DEMAND CHARACTERISTICS, USE INTERRELATIONSHIPS, AND COSTS AND BENEFITS ASSOCIATED WITH PARTICULAR USES AND USE METHODS. THE TERM WATER QUALITY CONTROL, AND POLLUTION ARE DEFINED. (GPO) (W69-04823)

00058. MODERN SEWAGE TREATMENT PLANTS-HOW MUCH DO THEY COST.

U.S. PUBLIC HEALTH SERVICE, WASHINGTON, D. C.

THIS STUDY IS BASED ON A TABULATION OF DESIGN AND COST INFORMATION FOR 1504 SEWAGE TREATMENT PROJECTS CONSTRUCTED UNDER THE PL-660 PROGRAM. TREATMENT PROCESSES COVERED INCLUDE: (1) IMHOFF-TANK PLANTS, (2) PRIMARY TREATMENT--SEPARATE SLUDGE DIGESTION PLANTS, (3) STABILIZATION PONDS, (4) ACTIVATED SLUDGE PLANTS, (5) TRICKLING FILTERS--SEPARATE SLUDGE DIGESTION PLANTS, AND (6) TRICKLING FILTERS-IMHOFF-TYPE PLANTS. (W69-05031)

00059. SOCIO-ECONOMIC ASPECTS OF WATER QUALITY MANANGEMENT.

KNEESE, A.V.
J WATER POLLUTION CONTROL FED., 36(2), 254-262, 1964.

THE AUTHOR LISTS THE FOLLOWING CONCEPTS AS USEFUL IN DEFINING THE NATURE OF WATER QUALITY MANAGEMENT: (1) A REGION APPROACH IS INVOLVED. (2) MULTIPURPOSE USE IS AN ESSENTIAL ELEMENT. (3) COMPREHENSIVENESS IS ESSENTIAL. (4) A SYSTEMATIC FOR ALTERNATIVES SHOULD BE INVOLVED. (5) FLEXIBLE

ADAPTATION TO EXISTING CONDITIONS IS NECESSARY. AN IMPORTANT ELEMENT IN ANALYSIS OF WATER QUALITY ALTERNATIVES IS IMPUTING VALUES TO WATER QUALITY LEVELS FOR VARIOUS USES SINCE MANY OF THE BENEFITS DERIVED FROM ENHANCEMENT OF WATER QUALITY ARE NOT MEASURED IN THE OPEN MARKET. DIFFICULT PROBLEMS IN IMPUTING VALUES OCCUR WITH RECREATION, PUBLIC HEALTH, AND THE GENERAL AMENITIES. [illegible]NIQUES WITH PROMISE IN TERMS OF EVALUATING [illegible]REATION ARE UNDER STUDY. PUBLIC HEALTH IS A MORE DIFFICULT PROBLEM. (W69-050[illegible])

00060. ESTIMATING SEWAGE TREATMENT PLANT OPERATION AND MAINTENANCE COSTS.

ROWAN, P.P.; JENKINS, K.C.; HOWELLS, D.H.

J WATER POLLUTION CONTROL FED., 33(2), 111-121, 1961.

COST DATA PRESENTED IN THIS REPORT REPRESENT TOTAL ANNUAL COST EXPERIENCE FOR THE OPERATION AND MAINTENANCE OF OVER 300 TREATMENT PLANTS IN THE CONTIGUOUS 48 STATES PLUS THE DISTRICT OF COLUMBIA. (W69-05051).

00061. TOWARD THE OPTIMIZATION OF INVESTMENT-PRICING DECISIONS: A MODEL FOR URBAN WATER SUPPLY TREATMENT FACILITIES.

RIORDAN, C.

PH.D. THESIS, CHAPTERS 4 AND 5, CORNELL U., FEB 1969. 304 P.

IN CHAPTER 4, A SINGLE STAGE CAPACITY EXPANSION MODEL WAS STRUCTURED FOR A HYPOTHETICAL MUNICIPAL WATER SUPPLY UTILITY. THE OBJECTIVE WAS TO DETERMINE THE OPTIMAL TIME AND SIZE OF TREATMENT PLANT EXPANSION IN ORDER TO MAXIMIZE TOTAL COMMUNITY NET BENEFITS OVER THE PLANNING HORIZON. TWO MODELS WERE SOLVED, ASSUMING ARITHMETIC AND EXPONENTIAL POPULATION GROWTH RATES RESPECTIVELY, UP TO AN ARBITARARY POPULATION STABILIZATION TIME. ASSUMPTIONS INCLUDED IDENTICAL LINEAR INDIVIDUAL DEMAND CURVES FOR WATER, CONSTANT MARGINAL COST OF PRODUCTION UP TO SYSTEM CAPACITY WHERE IT BECAME INFINITE, AND VARIABLE PRICING WHICH KEPT AGGREGATE DEMAND EQUAL TO SYSTEM CAPACITY AT ALL TIMES. GRID SAMPLING TECHNIQUES WERE USED TO LOCATE THE REGION OF THE OPTIMAL SOLUTION AND TO ESTABLISH THE CONCAVITY OF THE RESPONSE SURFACE, AND THE EXACT SOLUTION FOUND BY CALCULUS MAXIMIZATION. A SENSITIVITY ANALYSIS WAS PERFORMED ON THE PARAMETERS, AND THE RESULTS DISCUSSED. (W69-05129) IN CHAPTER 5, A MULTI-STAGE CAPACITY EXPANSION MODEL WAS STRUCTURED FOR A HYPOTHETICAL MUNICIPAL WATER SUPPLY UTILITY. THE OBJECTIVE WAS TO FIND THE OPTIMUM TIMING AND SIZING OF TREATMENT PLANT EXPANSIONS IN ORDER TO MAXIMIZE TOTAL COMMUNITY BENEFITS FOR THE PLANNING HORIZON. THE MODEL WAS SOLVED ON A DIGITAL COMPUTER USING A DISCRETE DYNAMIC PROGRAMMING ALGORITHM. BASIC ASSUMPTIONS FOR THE MODEL WERE IDENTICAL TO THOSE USED IN THE SINGLE STAGE EXPANSION MODEL. EXPONENTIAL AND ARITHMETIC POPULATION GROWTH PROBLEMS WERE SOLVED. SENSITIVITY ANALYSES ON STAGE TIME INTERVALS, INTEREST RATES, POPULATION GROWTH RATES AND PLANNING HORIZON LENGTHS WERE PERFORMED. COMPARISONS OF THE MODEL RESULTS WITH 'AVERAGE PRICE COSTING-EVEN DESIGN PERIOD' PLANNING METHODS WERE MADE. IT WAS CONCLUDED THAT THE MUTLI-STAGE MODEL (MARGINAL COST PRICING) RESULTED IN NET BENEFIT INCREASES OVER THE AVERAGE COST PRICING METHOD. CHAPTER 5 OF A THESIS. (W69-05130).

00062. INDUSTRIAL WASTEWATER RECLAMATION.

TAMBOW, C.A.

WATER AND SEWAGE WORKS, REFERENCE NO 1968, PP R220-R226, NOV. 29, 1968.

THE COSTS OF INDUSTRIAL WASTEWATER RECLAMATION ARE ANALYZED AND TABULATED. IN MANY AREAS, RECLAIMED WATER IS OF HIGHER QUALITY THAN UNTREATED WATER, SO IN SOME CASES RECLAMATION MAY BE THE MOST DESIRABLE SOLUTION ECONOMICALLY AND OTHERWISE, EVEN WHERE WATER IS ABUNDANT. THE TABULATED COST DATA INCLUDE CAPITAL COST OF TERTIARY TREAT
OF TERTIARY TREATMENT, BASIC SYSEM COSTS (ACTIVATED SLUDGE, COAGULATION, FLOCCULATION, CLARIFICATION, FILTRATION, AND CHLORINATION), BASIC SYSTEM COSTS LESS SECONDARY TREATMENT COSTS, ELECTRODIALYSIS COSTS, AND REVERSE OSMOSIS COSTS. (W69-04226).

MENT PLANTS, YEARLY OPERATING COSTS

00063. OCEAN OUTFALL DESIGN OF ECONOMY OF CONSTRUCTION.

PARKHURST, J.D.; HAUG, L.A.; WHITT, M.L.

J WATER POLLUTION CONTROL FED., 39(6), 987-993, 1967.

DESIGN REQUIREMENTS FOR SUBMARINE OUTFALLS FOR DISPOSAL OF METROPOLITAN SEWAGE WASTE ARE DESCRIBED. SPECIFICATION DATA AND COSTS OF CONSTRUCTION ARE GIVEN FOR FIVE MAJOR SUBMARINE OUTFALLS ON THE PACIFIC COAST OF THE UNITED STATES, WITH OVERALL LENGTHS RANGING FROM 3,650 FEET TO 22,000 FEET, AND WITH DESIGN CAPACITIES RANGING FROM 240 MGD TO 600 MGD. (W69-04313).

00064. MAN AND THE ESTUARY.

CONSERVATION FOUNDATION LETTER, APRIL 22, 1968, PP 8-11.

THE ECONOMIC BENEFITS AND USES OF THE ESTUARY ARE LISTED. THE ARTICLE MAINTAINS THAT THE BENEFITS OF ESTUARIES ARE FAIRLY EASY TO MEASURE, BUT THE ECONOMIC LOSSES FROM ABUSES OF THIS RESOURCE ARE HARDER TO ASSESS. SOME DATA ON ECONOMIC LOSSES FROM DREDGING, FILLING, AND POLLUTION OF ESTUARIES ARE GIVEN. (W69-04283).

00065. THERMAL POLLUTION: HOT ISSUE FOR INDUSTRY.

REMIERZ, R.

CHEMICAL ENGINEERING, 75(7), 48-52, 1968.

THIS ARTICLE DISCUSSES THE PROBLEM OF THERMAL POLLUTION AND PRESENTS SOME CURRENT INFORMATION ON THE SUBJECT. THE ARTICLE STATES THAT '. . . ABOUT 70% OF THE INDUSTRIAL THERMAL-POLLUTION LOAD IS ATTRIBUTED TO THE STEAM ELECTRIC-POWER INDUSTRY'. IT ALSO STATES THAT NUCLEAR PLANTS, EXPECTED TO BE A LARGE PERCENT OF FUTURE CONSTRUCTION, REJECT ABOUT 50 PERCENT MORE HEAT THAN FOSSIL FUEL PLANTS. RESERVOIRS OF COOLING TOWERS COULD ALLEVIATE THE PROBLEM, BUT MIGHT INCREASE THE COST OF ELECTRICITY ONE TO FIVE PERCENT. REUSE OF NOW WASTED HEAT IS ONE POSSIBILITY. (W69-04325).

REFERENCE LIST

NCES TO BE

00066. POLLUTIONAL EFFECTS OF PULP AND PAPER MILL WASTES IN PUGET SOUND.

REPORT OF FEDERAL WATER POLLUTION CON-TROL ADMINISTRATION, NORTHWEST REGIONAL OFFICE, PORTLAND, OREGON, AND WASHINGTON STATE POPULATION CONTROL COMMISSION, OLYMPIA, WASHINGTON, MARCH 1967.

THE STUDY'S CONCLUSIONS ARE PRIMARILY QUALITATIVE RATHER THAN QUANTITIATIVE. SPECIFIC RECOMMENDAIONS ARE MADE CONCERNING ACTIONS THAT THE MILLS SHOULD BE REQUIRED TO UNDERTAKE TO ABATE POLLUTION, BUT THESE RECOMMENDATIONS ARE APPARENTLY NOT BASED ON ANY QUANTITATIVE ESTIMATES OF DAMAGE CAUSED TO COMPETING USES, NORON ESTIMTAES OF INVESTMENT OUTLAYS WHICH WOULD BE REQUIRED TO SATISFY THE RECOMMENDATIONS. (W69-04319).

00067. PROTECTING THE POTOMAC AT WASHINGTON.

AULD, D.V.
J WATER POLLUTION CONTROL FED., 37(3), 275-288, 1965.

THE AUTHOR DESCRIBES A POLLUTION ABATEMENT PROGRAM AND INVESTMENTS IN THE WASHINGTON, D. C., METROPOLITAN AREA. BRIEF CAPITAL COST ESTIMATES OF ALTERNATIVE PLANS CONSIDERED BY THE WASHINGTON METROPOLITAN COUNCIL OF GOVERNMENTS ARE PRESENTED. THE POPULATION GROWTH IN THE WASHINGTON, D. C., METROPOLITAN AREA IS PROJECTEDTHROUGH THE YEAR 2000. CAPITAL-COST OUTLAYS FOR STORM AND SANITARY SEWER SEPARATION PROJECTS FOR SMALL SEGMENTS OF THE METROPOLITAN AREA ARE TABULATED. THESE COSTS ARE REPORTED TO HAVE AVERAGED ABOUT $1,500 PER HOUSE FOR DETACHED DWELLINGS WHEN CONTRACTS FOR SEPARATION HAVE INVOLVED GROUPS OF 30 TO 75 HOUSES. (W69-04437).

00068. WATER QUALITY AND POLLUTION CONTROL STUDY--JAMES RIVER BASIN.

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, MIDDLE ATLANTIC REGION, CHARLOTTESVILLE, VA. CB-SRBP WORKING DOCUMENT NO. 14, JUNE 1967.

THIS REPORT COVERS IMMEDIATE POLLUTION CONTROL NEEDS AND ESTIMATED COSTS FOR PROVIDING THESE NEEDS. THE PRESENT WATER-QUALITY CONDITIONS AND BIOLOGICAL STUDY OF THE UPPER REACHES OF THE JAMES RIVER AND TRIBUTARIES ARE SUMMARIZED. THE FOLLOWING BASIC CRITIERIA WERE USED IN ACHIEVING COST ESTIMATES FOR NEW FACILITIES: (1) DISSOLVED OXYGEN NOT LOWER THAN 4 MG/I IN THE STREAM, (2) NO APPRECIABLE SETTLEABLE OR FLOATING SOLIDS, (3) NO NOTICEABLE COLORATION OR DISCOLORATION OF RECEIVING STREAMS, (4) TOXIC SUBSTA
REDUCED BELOW THE TOXICITY OF STREAMS, (5) NO APPRECIABLE CHANGE IN PH OF THE RECEIVING STREAMS, AND (6) STREAM FLOW FOR DESIGN OF SEWAGE TREATMENT FACILITIES EQUAL TO MINIMUM AVERAGE SEVEN-DAY LOW FLOW OCCURING ON 10-YEAR FREQUENCY. (W69-04359).

00069. NUTRIENTS.

BREHMER, M.L.
INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN, WASHINGTON, D.C., PROBLEMS OF THE POTOMAC ESTUARY, JANUARY, 1964, PP 47-50.

THE AUTHOR BRIEFLY DISCUSSES THE PROBLEM OF SECONDARY POLLUTION STEMMING FROM EXCESSIVE NUTRIENTS OF SEWAGE ORIGIN IN RECEIVING WATERS, WITH SPECIFIC REFERENCE TO THE POTOMAC ESTUARY. HE PRESENTS ESTIMATES OF THE DAILY PHOSPOROUS AND NITROGEN ENRICHMENT OF THE POTOMAC ESTUARY BY WASHINGTON, D. C. RESEARCH IS ADVISED IN METHODS OF SEWAGE TREATMENT TO REMOVE PHOSPHOROUS AND NITROGEN FROM SEWAGE EFFLUENTS AS AN ECONOMIC BY-PRODUCT. THE NITROGEN AND PHOSPHOROUS CONTENT OF SEWAGE FROM WASHINGTON, D. C., IF VALUED AT 10 CENTS AND 8 CENTS RESPECTIVELY PER POUND, WOULD HAVE A RECOVERED VALUE OF ABOUT $3,150,000 ANNUALLY, AS COMPARED WITH THE PRESENT ANNUAL OPERATING COST FOR THE SEWAGE TREATMENT SYSTEM OF ABOUT $2,100,000. (W69-04448).

00070. WATER QUALITY, A PROBLEM FOR THE ECONOMIST.

CIRIACY-WANTRUP, S.V.
JOURNAL OF FARM ECONOMICS, 43(5), DECEMBER, 1961.

A GENERAL DISCUSSION OF THE INCIDENCE OF SOCIAL COSTS AND BENEFITS IN WATER QUALITY MANAGEMENT IS PRESENTED. POLITICAL AND ECONOMIC FACTORS PERTINENT TO FORMULATION OF POLICY OBJECTIVES IN WATER QUALITY MANAGEMENT ARE CONSIDERED. ARGUMENTS ARE PRESENTED FOR A MINIMUM QUALITY STANDARD FOR RECEIVING WATERS, BASED ON THE QUALITY REQUIRED TO SUPPORT FISH LIFE. (W69-04457).

00071. OPERATING COSTS OF WASTE TREAT IN GENERAL MOTORS.

BRINK, R.J.
NINETEENTH INDUSTRIAL WASTE CONFERENCE, PROCEEDINGS, JANUARY, 1965, PP 12-1.

THE COSTS OF WASTE-WATER TREATMENT AT THE [illegible] DIVISION OF GENERAL MOTORS CORPORATION ARE REPORTED. (W69-04451).

00072. WATER QUALITY IMPROVEMENT PROGRAMMING PROBLEMS.

SOBEL, M.J.
WATER RESOURCES RESEARCH, 1(3), 477-487, 1965.

IN RECENT YEARS, THE RATE OF INVESTMENT IN FACILITIES FOR WATER-QUALITY CONTROL HAS INCREASED, AND THE NEED TO PROGRAM WATER-RESOURCES USE ON A REGIONAL BASIS HAS BEEN RECOGNIZED. THIS PAPER OUTLINES THE NATURE OF REGIONAL WATER-QUALITY SYSTEMS AND PRESENTS PROGRAMMING MODELS FOR SEVERAL WATER-QUALITY IMPROVEMENT PROBLEMS. A LINEAR PROGRAMMING FORMULATION OF A STATIC IMPROVEMENT IN QUALITY IS CONTRASTED WITH A TRADITIONAL POLICY FOR PROGRAMMING IMPROVEMENTS; THE TRADITIONAL POLICY RESULTS IN A MIXED-INTEGER PROBLEM. THE MAXIMIZATION OF THE RATIO OF BENEFITS TO COSTS OF AN IMPROVEMENT PROGRAM IS TRANSFORMED TO A LINEAR PROGRAMMING PROBLEM. A STOCHASTIC NATURAL ENVIRONMENT LEADS TO OTHER PROGRAMMING MODELS. THE APPLICATION OF LEAST-COST MODELS IS ALSO DISCUSSED. (W69-04502).

00073. DEEDS AND DATA.

J WATER POLLUTION CONTROL FED., 36(4), 517-519, 19

THE ARTICLE PRESENTS OPERATING AND MAINTENANCE COST EXPERIENCE FOR SECONDARY SEWAGE TREATMENT FACILITIES FOR PLANTS OF NINE MUNICIPALITIES, WITH AVERAGE DAILY SEWAGE PER PLANT IN RANGE OF 0.2 TO 51.6 MGD. (WL9-04465).

64.

00074. WATER IN INDUSTRY: A SURVEY OF WATER USE IN INDUSTRY.

NATIONAL ASSOCIATION OF MANUFACTURES, IN NEW YORK; AND CHAMBER OF COMMERCE OF THE UNITED STATES, WASHINGTON, D.C., REPORT, JANUARY, 1965.

THE FINDINGS OF A SURVEY OF INDUSTRIAL WATER USE AND WASTE TREATMENT ARE REPORTED. INTAKE WATER VOLUME AND PROCESS WATER TREATMENT COSTS ARE ESTIMATED FOR VARIOUS INDUSTRIES. OPERATING AND CAPITAL REPLACEMENT COSTS ARE ALSO ESTIMATED FOR EFFLUENT TREATMENT FACILITIES. SUNDRY OTHER QUANTITATIVE ESTIMATES RELATING TO INDUSTRIAL WATER USE, INCLUDING SALT OF BRACKISH WATER INTAKE FOR SEVERAL INDUSTRIES, ARE GIVEN. SEPARATE SECTIONS ARE INCLUDED FOR THE FOLLOWONG INDUSTRIES: AUTOMOBILE INDUSTRY, SUGAR BEET INDUSTRY, BITUMINOUS COAL INDUSTRY, CANE SUGAR INDUSTRY, CHEMICAL MANUFACTURING, GRAIN BEVERAGE DISTILLING INDUSTRY, INVESTOR-OWNED ELECTRIC UTILITY INDUSTRY, INDUSTRIAL LAUNDERING, MEAT INDUSTRY, PETROLEUM REFINERIES, PULP AND PAPER INDUSTRY, SOAP AND DETERGENT INDUSTRY, STEEL INDUSTRY, AND TANNING-LEATHER INDUSTRY. (W69-04514).

00075. RECENT RESULTS FROM A MATHEMATICAL MODEL OF WATER POLLUTION CONTROL IN THE DELAWARE ESTUARY.

THOMANN, R.V.

WATER RESOURCES RESEARCH, 1(3), 349-359, 1965.

THE BASIC CONCEPTS OF SYSTEMS ANALYSIS AND OPTIMUM (LEAST-COST) WATER POLLUTION ARE PRESENTED. THE EQUATION UTILIZED TO DESCRIBE THE TIME AND SPACE VARIABILITY OF DISSOLVED OXYGEN ARE PRESENTED IN A SYSTEMS ANALYSIS CONTEXT, AND THEIR USEFULNESS IN THIS FORM IS DISCUSSED. THE APPLICATION OF THE MATHEMATICAL MODEL TO THE CONTROL OF DISSOLVED OXYGEN IN THE DELAWARE ESTUARY IS GIVEN. RECENT COMPUTER SOLUTIONS ARE ILLUSTRATED, AND THE SENSITIVITY OF THE LEAST-COST DISSOLVED-OXYGEN IMPROVEMENT SOLUTIONS TO THE RATE OF ATMOSPHERE REAERATION IS PRESENTED. (W69-04507).

00076. FLOOD AND POLLUTION CONTROL: A DEEP TUNNEL PLAN FOR THE CHICAGOLAND AREA.

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, 100 EAST ERIE STREET, CHICAGO, ILLINOIS 60611, MAY 1966. 61 P.

AFTER DESCRIBING RAINSTORM, FLOODING AND WATERWAY POLLUTION PROBLEMS IN METROPOLITAN CHICAGO, THE PREFEASIBILITY REPORT REVIEWS SIX ALTERNATIVE UNDERGROUND STORAGE PLANS. IT RECOMMENDS A COMPREHENSIVE DEEP TUNNEL PLAN. ENGINEERING DESIGN CRITERIA FOR THE PLAN ARE CONSIDERED. THE MAJOR COMPONENTS OF THE PLAN ARE DESIGNED WITH ENOUGH PRECISION TO ALLOW PREFEASIBILITY COST ESTIMATES. THEY INCLUDE LATERAL SEWERS, NEW MAIN SEWERS, VERTICAL DRAINS, AN UNDERGROUND RESERVIOR, PUMPED-STORAGE POWER, A SURFACE RESERVOIR, AND POLLUTION TREATMENT. THE COSTS OF UNDERGROUND EXCAVATION, OF PLAN COMPONENTS, AND OF CONTINGENCY AND OVERHEAD ARE GIVEN. COMPARATIVE FLOOD CONTROL BENEFITS ARE DISCUSSED IN TERMS OF BASEMENT FLOODING, FLOODING OF INDUSTRIAL AREAS, LAND ENHANCEMENT, AND FLOOD REDUCTION ON THE WATERWAY SYSTEM. ALTERNATIVE COSTS ARE GIVEN. COMPARATIVE POLLUTION ABATEMENT BENEFITS ARE NOT CLEARCUT, BEACUSE THE DEEP TUNNEL PLAN ALONE WILL NOT SIGNIFICANTLY REDUCE POLLUTION THROUGHOUT THE ENTIRE WATERWAY SYSTEM. THE REPORT GIVES COMPARATIVE COSTS FOR TWO METHODS OF STORING AND TREATING COMBINED OVERFLOWS. POSSIBILITIES OF A BETTER SCHEME OF SEPARATING STORM AND SANITARY SEWERS MUST BE INVESTIGATED. POTENTIAL BENEFITS AND COSTS OF TERTIARY AND SPACE TREATMENT REQUIRE FURTHER INVESTIGATION. THE REPORT CONCLUDED THAT THE PLAN MERITS ENGINEERING FEASIBILITY STUDIES. APPENDICES DISCUSS EXTENSIVELY HYDROLOGY, GEOLOGY, WATER QUALITY, AQUIFER PROTECTION, POWER, COSTS, AND BENEFITS. (W69-04630).

00077. WATER POLLUTION CONTROL FACTS.

REPORT, FEDERAL WATER POLLUTION CONTROL FEDERATION, WASHINGTON, D.C., 1965.

THIS REPORT DISCUSSES VARIOUS PERTINENT STATISTICAL DATA REGARDING POLLUTION CONTROL REQUIREMENTS AND COSTS, DRAWN FROM VARIOUS PUBLICLY AVAILABLE PUBLICATIONS. THE CONTENT IS INDICATED BY THE FOLLOWING TABLE HEADINGS: NEW SEWER AND WATER CONSTRUCTION PUT IN PLACE IN THE UNITED STATES, 1963, 1964, AND OUTLOOK FOR 1965; CONSTRUCTION NEEDS FOR SEWERAGE UTILITIES, PUBLIC AND PRIVATE, 1962-70; ESTIMATED COSTS FOR COMPLETE SEPARATION OF STORMWATER AND SANITARY SEWERS, ESTIMATED COSTS FOR PARTIAL SEPARATION OF STORMWATER AND SANITARY SEWERS; SUMMARY OF THE BACKLOG OF MUNICIPAL WASTEWATER TREATMENT NEEDS, 1964; PRESENT MUNICIPAL WASTEWATER TREATMENT NEEDS, REQUIRED ANNUAL CONSTRUCTION RATES, MUNICIPAL WASTEWATER TREATMENT WORKS; INCREASE IN ORGANIC INDUSTRIAL WASTES (INDUSTRIAL); 1959 OPERATING AND REPLACEMENT COSTS FOR INDUSTRY WASTEWATER TREATMENT FACILITIES. INDUSTRIAL PLANTS PROVIDING NO TREATMENT IN 1959; TREATMENT PROCESSES MOST FREQUENTLY MENTIONED BY 2,162 RESPONDENTS; WATER PLANS, AND 1959 CAPITAL EXPENDITURES FOR CONSTRUCTION OF WASTEWATER COLLECTION AND TREATMENT SYSTEMS BY PERCENT AND DOLLAR DISTRIBUTION. (W69-04515).

00078. CHICAGO TUNNEL DRAINAGE PROJECT: PRELIMINARY EVALUATION OF FEASIBILITY.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CHICAGO, ILLINOIS, MAY 1964. 33P.

APPROXIMATELY A THIRD OF THE PRELIMINARY STUDY DESCRIBES THE PROJECT PLAN, ANOTHER THIRD ECONOMICS, AND THE FINAL THIRD PROBLEMS FOR INVESTIGATION. IT RECOMMENDS THAT AN UNDERGROUND STORAGE SYSTEM, COMBINED WITH STORAGE IN A HIGHER LEVEL SEWER SYSTEM, BE DESIGNED FOR THE CHICAGO FLOOD OF RECORD. CAPACITIES, TYPES, AND CONSTRUCTION OF PROPOSED STORAGE STRUCTURES ARE DISCUSSED. THE PUMPED STORAGE FACILITIES OF THE

PROJECT WOULD RELEASE WATER TO THE LOWER RESERVOIR DURING PEAK POWER LOAD PERIODS AND PUMP IT BACK TO THE UPPER RESERVOIR DURING OFF-PEAK HOURS. LAYOUT, STORAGE CAPACITY, AND ALTERNATIVE LOCATIONS ARE DISCUSSED. (W69-04631).

00079. MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION.

REID, G.W.; STREEBIN, L.E.; NELSON, R.Y.; LOVE, O.T.

PROC THIRD ANNUAL AMERICAN WATER RESOURCES CONF, SAN FRANCISCO, PP 339-350, NOVEMBER 1967.

MODELS WERE DEVELOPED TO DEPICT WASTE DILUTION FLOWS USED WITH PROJECTIONS OF RESERVIOR AND TREATMENT COSTS TO PROVIDE OPTIMAL COMBINATIONS OF LOW FLOW AUGMNTATION AND WASTE TREATMENT. PROJECTIONS OF MUNICIPAL AND INDUSTRIAL LOADINGS WERE DEVELOPED ON A NATIONWIDE DATA BASE USING STANDARD STATISTICAL METHODS. THE STUDY REVEALED MEAN AND VARIANCES OF STRENGTH AND DISCHARGES. A SIMILAR STUDY DEVELOPED TREATMENT EFFICIENCY MATRICES AND CORRESPONDING TREATMENT COSTS. THESE COSTS REFLECTED SCALE EFFECTS, AND WERE PRESENTED IN TERMS OF CAPITAL, OPERATION, AND MAINTENANCE COSTS. A NOVEL TECHNIQUE EMPLOYING MICRO AND MACRO MODELS AND 'TUNNEL' PROCEDURE WAS USED TO DISAGGREGATE NATIONAL VALUES AND TO PROVIDE BASIN LOADING LEVEL FORECASTS. STREAM INPUT-OUTPUT MODELS WERE DEVELOPED IN TERMS OF RESPONSES TO IMPRESSED LOADS, CHARACTERIZED AS BIODEGRADABLE, NUTRITIONAL, PERSISTENT CHEMICAL, AND THERMAL. THE MODELS WERE DEVELOPED AS A FUNCTION OF STREAM PARAMETERS. THE LOADS AND STREAM RESOURCES WERE TREATED ON A BASIN LEVEL IN THESE MACRO LEVEL MODELS. THE MODEL PROVIDES OPTIMAL OR LEAST COST COMBINATION OF WASTE TREATMENT AND DILUTION. (W70-00064).

00080. AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL.

ORTOLANO, L; THOMAS, H.A. JR.

HARVARD WATER PROGRAM, DISCUSSION PAPER NO 67-4, HARVARD UNIV, NOV. 1967. 37P.

A SERIES OF MATHEMATICAL PROGRAMMING MODELS WERE PRESENTED TO INVESTIGATE THE RELATIVE MERITS OF: (1) PRIMARY; (2) SECONDARY; AND (3) TERTIARY SEWAGE TREATMENT PLANTS; (4) INCREASE IN STREAM REAERATION COEFFICIENTS; (5) CONTROL OF COMBINED SEWER OVERFLOWS; (6) REMOVAL OF BOTTOM SEDIMENTS; AND (7) PIPING OF WASTES OUTSIDE BASIN FOR OCEAN DISPOSAL, IN A PROGRAM TO MAINTAIN A GIVEN DO CONCENTRATION AT MINIMUM COST. SAMPLE COMPUTATIONS AND RESULTS FOR THE DELAWARE ESTUARY WERE SHOWN. THE MODELS WERE USED AS PRELIMINARY SCREENING TOOLS, BEGINNING WITH SIMPLIED STATIC MODELS OF THE ESTUARINE GEOMETRY, AND EVOLVING TO SECTIONED DYNAMIC MODELS. (W69-04142).

00081. OPTIMAL WATER QUALITY MANAGEMENT AND MULTI-COMPONENT EFFLUENT CONTROL BY MEANS OF LINEAR PROGRAMMING.

CAREW, J.P.; VAN SLYKE, R.M.

OPERATIONS RESEARCH CENTER REPORT 68-1, UNIV OF CALIF, BERKELEY, JAN. 1968. 25 P.

A LINEAR PROGRAMMING MODEL FOR MULTICOMPONENT EFFLUENT CONTROL WAS PRESENTED. THE OBJECTIVE OF THE MODEL WAS TO PRESCRIBE LEVELS OF TREATMENT BY INDUSTRIAL AND PUBLIC CLASSES OF EFFLUENT DISCHARGERS IN ORDER TO MINIMIZE TOTAL COST OF TREATMENT, SUBJECT TO WATER QUALITY CONSTRAINTS. COMPUTED COSTS PER UNIT OF EACH EFFLUENT COMPONENT WERE OBTAINED, ALLOWING COMPARISON OF COSTS FOR DIFFERENT EFFLUENT COMPOSITION, EVALUATION OF PROPOSED TREATMENT SCHEMES, AND ESTIMATION OF THE EFFECTS OF CHANGING QUALITY STANDARDS AND INCREASED DISCHARGER ON OPTIMAL TREATMENT POLICIES. IT WAS CONCLUDED THAT PROJECTIONS OF FUTURE ECONOMIC ACTIVITY COULD BE USED WITH THE MODEL TO PREDICT FUTURE DEMANDS ON TREATMENT CAPABILITY. (W69-04147).

00082. A HEURISTIC AID FOR THE DESIGN OF SEWER NETWORKS.

LIEBMAN, J.C.

PROC, AMER SOC CIVIL ENG, 93(SA4) 81-90, 1967.

AN ITERATIVE SEARCH METHOD, PROGRAMMED FOR USE ON A DIGITAL COMPUTER, WHICH SOUGHT IMPROVED LAYOUTS IN GRAVITY FLOW SEWAGE COLLECTION NETWORKS, WAS PRESENTED. THE METHOD REQUIRED AN ORIGINAL NODE-LINK LAYOUT, SELECTED BY ENGINEERING JUDGEMENT, AND AN ITERATIVE SEARCH FOR COST-REDUCING ADJUSTMENTS. AT EACH NODE AN UNUSED LINK WAS CHECKED TO SEE IF REPLACEMENT REDUCED COSTS, THE SEARCH BEGAN AT THE FIRST NODE AGAIN. THE PROGRAM ENDED WHEN NO IMPROVEMENTS COULD BE FOUND. NO GUARANTEE OF AN OPTIMAL SOLUTION WAS OBTAINED, AS ILLUSTRATED BY DIFFERENT ORIGINAL NETWORK SELECTIONS FOR A HYPOTHETICAL EXAMPLE. HOWEVER, THE SAME LEAST COST SOLUTION WAS FOUND FOR MOST ORIGINAL NETWORKS CHOSEN. (W69-06498).

00083. ECONOMIC EFFECTS OF MINERAL CONTENT IN MUNICIPAL WATER SUPPLIES.

RESEARCH AND DEVELOPMENT REPORT NO 260, OFFICE OF SALINE WATER, U S DEPT OF INTERIOR, MAY 1967. 159 P.

THE PURPOSE OF THIS REPORT IS TO EVALUATE THE ECONOMIC EFFECT OF MINERAL CONTENT OF WATER SUPPLIES UPON THE FACILITIES OF WATER AND SEWAGE UTILITIES AND UPON THE CUSTOMERS. THE ADVERSE EFFECTS OF MINERALIZED WATER RESULT PRINCIPALLY FROM CORROSION, ENCRUSTATION AND RELATED PROBLEMS OF BOTH THE WATER UTITLITY AND CUSTOMER FACILITIES. THE ECONOMIC EFFECTS OF USING A WATER SUPPLY OF A PARTICULAR MINERAL CONTENT AS COMPARED TO AN ALTERNATE CONTENT COULD HAVE A MARKED EFFECT UPON THE ECONOMICS OF SELECTION OF THE SOURCE TO BE DEVELOPED. EMPHASIS HAS BEEN PLACED ON ESTIMATING THE COST EFFECTS RESULTING FROM THOSE MINERALS NOT READILY AND ECONOMICALLY REMOVED OR NEUTRALIZED IN CONVENTIONAL WATER TREATMENT PROCESSES. (W69-06555).

00084. WATER QUALITY MANAGEMENT: ENGINEERING-ECONOMIC FACTORS IN MUNICIPAL WASTE DISPOSAL.

FRANKEL, R.J.
WATER RESOURCES RES, 1(2), 173-186, 2ND QUARTER, 1965.

THE RESULTS OF A RIVER BASIN COMPUTER STUDY, WHICH DETERMINED THE SAVINGS OF DOWNSTREAM TREATMENT COST RESULTING FROM INCREMENTAL UPSTREAM WASTE TREATMENT, WERE PRESENTED. HYDROLOGIC DATA FROM THE EEL RIVER IN CALIFORNIA WERE INCORPORATED IN THE DYNAMIC OXYGEN SAG MODEL DEVELOPED. PRINCIPLE VARIABLES OF THE MODEL WERE ORIGINAL STREAMFLOW QUANTITY AND QUALITY, HYDRAULIC AND PHYSIOGRAPHIC CHARACTERISTICS OF THE STREAM, DEGREE OF STREAM SELF-PURIFICATION, TREATMENT LEVEL, DISTANCE AND REQUIRED USE BETWEEN COMMUNITIES, AND WATER TREATMENT LEVEL AT THE DOWNSTREAM COMMUNITY. IT WAS CONCLUDED THAT MAXIMAL RETURN PER ADDITIONAL INVESTMENT DOLLAR IS FROM PRIMARY TO SECONDARY SEWAGE TREATMENT (COST-SAVINGS RATIOS FROM NEGLIGIBLE TO 0.10). THE QUANTITY OF WITHDRAWAL OF MUNICIPAL WATER SUPPLY REQUIRED TO JUSTIFY UPSTREAM TREATMENT VARIES FROM 16 TO 250: 1 FOR SMALL SEWAGE PLANTS TO 10 TO 30: 1 FOR LARGE PLANTS, IF IN-PLACE STREAM QUALITY IS UNIMPORTANT. (W69-06505).

00085. ROLE OF GROUND WATER CONTAMINATION IN WATER MANAGEMENT.

LEGRAND, H.E.
AM WATER WORKS ASSOC JOUR, 59(5), 557-565, 1967.

GROUND-WATER CONTAMINATION ASPECTS SHOULD NOT BE EXCLUDED IN LONG-RANGE INTEGRATED COMMUNITY PLANS, ESPECIALLY IN URBAN AREAS AND SUBURBS. THEY INCLUDE ANY DETERIORATION OF QUALITY OF WASTE DISPOSAL PRACTICES, ARTIFICIAL RECHARGE OF AQUIFERS, ACCIDENT, OR SALT WATER AT SHALLOW OR UNDERLYING DEPTHS. THESE PROBLEMS WILL INCREASE UNDER CURRENT PRACTICES WHILE MINIMIZING COSTS FOR COORDINATED EFFORTS FROM SEVERAL DISCIPLINES. TECHNICALLY TRAINED PERSONNEL, CAPABLE OF DETERMINING BEST USE OF LAND FOR WATER SUPPLY AND WASTE DISPOSAL, ARE RARELY A PART OF WATER RESOURCES ADMINISTRATIVE MACHINERY. SPECIFIC PROBLEMS ARE MORE OFTEN DEALT WITH THAN LONG-RANGE PLANNING. COMPLEX HYDROGEOLOGIC CONDITIONS MUST BE EVALUATED BEFORE DECISIONS ARE MADE AND POLICIES ESTABLISHED. (W69-06762).

00086. UNDERGROUND WASTE DISPOSAL.

WRIGHT, J.L.
IND WATER ENG, 6(5) 24-27, 1969.

DEEP-WELL DISPOSAL OF INDUSTRIAL WASTES IS RECOMMENDED FOR AREAS WHERE LAWS AND GEOLOGICAL FORMATIONS ARE FAVORABLE. THE GEOLOGY OF SEVERAL AREAS WITH FAVORABLE GEOLOGIC CONDITIONS IS DISCUSSED AND ESTIMATED COSTS OF INJECTION AND SURFACE DISPOSAL ARE TABULATED. (W69-06943).

00087. OIL POLLUTION- A REPORT TO THE PRESIDENT.

SPEC REP TO THE PRES BY DEP OF INTERIOR AND DEP OF TRANSPORTATION, FEB. 1968.

A SPECIAL REPORT BY THE U. S. DEPARTMENTS OF INTERIOR AND TRANSPORTATION DISCUSSES THE CAUSES, SOURCES, EFFECTS, HANDLING AND PREVENTION OF OIL SPILLS AT SEA AND ON INLAND WATERS. DISPOSAL OF WASTE OIL BY SERVICE STATIONS AND INDUSTRIAL PLANTS IS ALSO A SERIOUS AND GROWING PROBLEM. PRESENT CAPABILITIES OF HANDLING SPILLS AND PRESENT INTERNATIONAL REGULATION OF DISCHARGES ON INTERNATIONAL WATERS ARE INADEQUATE. LEGAL, TECHNICAL, INDUSTRIAL, AND COST ASPECTS OF PREVENTION ARE DISCUSSED. PHYSICAL AND LEGAL FACILITIES FOR CLEANUP OF OIL SPILLS ARE DESCRIBED. PRESENT ACTION PROGRAMS INVOLVING STUDY, RECOMMENDATIONS, REGULATIONS, ENFORCEMENT, LEGISLATION, INTERNATIONAL CONVENTIONS, AND FISCAL SUPPORT ARE LISTED. (W69-06237).

00088. ON THE NATURE AND SIGNIFICANCE OF SOCIAL COSTS.

KAPP, K.W.
KYKLOS, VOL 22, FASC 2, PP 334-347, 1969. 14 P.

THIS PAPER DISCUSSES THE CHALLENGING DIFFICULTIES TO ECONOMIC ANALYSIS PRESENTED BY THE PROBLEM OF SOCIAL COST. IT REMAINS DOUBTFUL WHETHER THESE DIFFICULTIES CAN BE COPED WITH ADEQUATELY WITHIN THE TRADITIONAL BOUNDARIES OF ECONOMIC SCIENCE. NEITHER THE THEORY OF RESOURCE ALLOCATION NOR APPLIED ECONOMICS SEEM TO PROVIDE ADEQUATE CATEGORIES FOR THE THEORETICAL TREATMENT OF SOCIAL COSTS OR PRACTICAL GUIDELINES FOR THEIR CONTROL. THE CONCEPT OF SOCIAL COSTS, ITSELF, WAS DEVELOPED AS AN ANALYTICAL INSTRUMENT AND A A CRITIQUE OF THE METHOD AND SCOPE OF CLASSICAL AND NEOCLASSICAL ECONOMIC ANALYSIS. SOCIAL COSTS REFER TO CONSEQUENCES OF PRODUCTIVE ACTIVITES AND POLICY DECISIONS WHICH, FOR SEVERAL REASONS, CARRY AN INEVITABLE RESIDUUM OF INDETERMINACY BUT WHICH ARE NEVERTHELESS REAL AND IMPORTANT, EVEN THOUGH THEIR APPROXIMATE MAGNITUDE CAN BE DETERMINED ONLY AFTER CAREFUL STUDY WHICH IN MANY INSTANCES CALL FOR AN EVALUATION BASED UPON CRITERIA OTHER THAN MARKET VALUES. THE AUTHOR SUGGESTS WIDER CONCEPTS OF SOCIAL COSTS AND SOCIAL BENEFITS THAN THOSE THAT EMERGE FROM AN ATTEMPT TO INCORPORATE THESE NOTIONS INTO TRADITIONAL THEORY. SOCIAL COSTS ARE CLOSELY INVOLVED WITH WATER POLLUTION PROBLEMS AND AS SUCH THIS ARTICLE PRESENTS A GENERAL TREATMENT OF THE ECONOMIC BASIS OF THE SOCIAL COST CONCEPT FOR THE WATER RESEARCHER. (W69-07171).

00089. THE COST OF CLEAN WATER AND ITS ECONOMIC IMPACT.

FED WATER POLLUT CONTR ADMIN REP ON CLEAN WATERS, VOL 1, JAN. 1969. 220 P.

NATIONAL REQUIREMENTS AND COSTS OF WATER POLLUTION CONTROL ARE SUMMARIZED AND NATIONAL CLEAN WATER GOALS ARE OUTLINED. OVER 90% OF THE NATION'S SEWERED POPULATION IS ALSO SERVED BY WASTE TREATMENT PLANTS, AND 60% WITH SECONDARY TREATMENT. PREVALENCE OF TREATMENT IS GREATEST WEST OF THE MISSISSIPPI. MOST OF THE UNTREATED DISCHARGE IS IN NEW ENGLAND, NEW YORK, AND PENNSYLVANIA. GENERALLY, INDUSTRIAL WASTE-HANDLING IMPROVEMENT INVESTMENT IS AT ABOUT THE

LEVEL RECOMMENDED BY FWPCA, BUT MUNICIPALITIES ARE SPENDING HALF THE AMOUNT. THE PROBLEMS AND RECOMMENDATIONS MADE FOR IMPROVEMENT OF PRESENT TREATMENT AND ADDITION OF NEW FACILITIES ARE DISCUSSED IN DETAIL. (W69-7109).

00090. A STUDY OF THE EXPENDITURES FOR URBAN WATER SERVICES.

CLEM, L.H.
ASCE URBAN WATER RESOURCES RES PROGRAM TECH MEM NO 7, FEBUARY 1969. 21 P.

A STUDY WAS UNDERTAKEN TO DETERMINE THE FEASIBILITY OF AND PROVIDE GUIDELINES FOR ANALYZYING ALL URBAN WATER SERVICE COSTS AND TO DETERMINE THEIR RELATIONSHIP TO OTHER LOCAL GOVERNMENT EXPENDITURES, SUCH AS EDUCATION, PUBLIC WORKS, AND LAW ENFORCEMENT. THE CITY OF HARTFORD WAS CHOSEN FOR THE PILOT INVESTIGATION BECAUSE THE MANAGER'S FISCAL PRACTICES WERE SUITABLE AND APPROPRIATE RECORDS WEREAVAILABLE, AND THE COOPERATION OF KEY CITY PERSONNEL WAS PROMISED. TOTAL COST OF HARTFORD'S WATER SERVICES HAS DECREASED FROM $8.5 MILLION (17. 4% OF ANNUAL CITY BUDGET) IN 1965 TO $5.1 MILLION (7.4% OF BUDGET) IN 1968. THE DECREASE IS DUE TO COMPLETION OF A MAJOR STORM DRAINAGE PROJECT. WATER SALES WERE NEARLY CONSTANT AT ABOUT $2.4 MILLION DURING EACH OF THE 4 YEARS UNDER REVIEW. THE CITY IS THE MAJOR PARTICIPANT IN THE LOCAL METROPOLITAN WATER DISTRICT WHICH ALSO EMBRACES MANY ADJACENT TOWNS. HARTFORD HAS OVER THE YEARS BEEN SUBJECTED TO CATASTROPHIC FLOODING FROM THE CONNECTICUT RIVER. LOCAL EFFORTS AND THE CORPS OF ENGINEERS HAVE WORKED IN CONJUNCTION TO ELIMINATE THE FLOODING PROBLEM, BUT THE CITY HAS LOW-LYING AREAS REQUIRING STORM RUNOFF PUMPING. AT PRESENT, THE SEWARAGE AND STORM DRAINAGE SYSTEMS ARE COMBINED BUT STEPS ARE BEING TAKEN TO SEPARATE THEM. URBAN WATER SERVICE COSTS CAN BE ANALYZED AND THEIR RELATIONSHIP TO OTHER LOCAL EXPENDITURES DETERMINED. AN APPROACH RECOMMENDED FOR NATIONWIDE STUDIES IS GIVEN. (PB-184 702) (W69-07483).

00091. EROSION CONTROL AT HOLLINGER MINE TAILING SITE.

GORDON, I.M.
J CAN MINING, 90(6), 46-50, 1969.

THE BEST METHOD OF PROTECTION FROM EROSION OF THE HOLLINGER MINE TAILINGS WAS INVESTIGATED BY PLANTING GRASS AND TREES (POPLAR, JACKPINE, BLACK SPRUCE, ETC.) ON THE SLOPES AND PLATEAU OF THE TAILING DEPOSIT OF 70 TO 90 FT ABOVE THE ORIGINAL LOW-LYING GROUND. THE ARTICLE CONTAINS THE FOLLOWING BRIEF CHAPTERS: (1) LONG-TERM PLANNING; (2) EROSION CONTROL OF SLOPES; (3) EROSION CONTROL OF THE PLATEAU; (4) DESCRIPTION OF GRASSES; (5) METHOD OF SEEDING AND SEED MIXTURES, (6) METHOD OF PLANTING TREES AND TYPE OF NURSERY STOCK USED, AND (7) CONCLUDING REMARKS. THE RESULTS OF THE APPLICATION OF GRASS AND TREE PLANTING TO THE TAILING DEPOSIT CAN BE CONSIDERED AS ENTIRELY SATISFACTORY BECAUSE GRASSES AND TREES ARE GROWING ON THE SLOPES AND THE 100-FT HIGH PLATEAU IS GRADUALLY BECOMING PARKLAND. (W69-07489).

00092. POTENTIAL REUSE OF EFFLUENT AS A FACTOR IN SEWERAGE DESIGN.

WHETSTONE, G.A.
WATER POLLUTION CONTROL RESEARCH SERIES WP-20-AWTR-18, FWPCA, ROBERT A. TAFT SANITARY ENGINEERING CENTER, FEBRUARY 1967, 219 P.

TRADITIONALLY, OVERLOADED SEWERS HAVE BEEN PARALLELLED OR REPLACED. MODERN SEWAGE TREATMENT PLANTS, CAPABLE OF PRODUCING HIGH-QUALITY EFFELUENT BY NUISANCE-FREE PROCESSES ON SMALL PLOTS OF LAND, PERMIT A MORE SATISFACTORY SOLUTION. NOW, A PLANT MAY BE PLACED WITHIN CONVENIENT DISTANCE OF THE POINT OF INCIPIENT OVERLOAD, AND THE EFFLUENT MAY BE EMPLOYED FOR A BENEFICIAL CONSUMPTIVE USE NEAR THE TREATMENT PLANT. THUS EXISTING SEWERS REMAIN ADEQUATE, OR NEW SEWERS MAY BE PLANNED WITH LESS PROVISION FOR UNKNOWABLE FUTURE LOADS. (W69-08262).

00093. REUSE CAN BE CHEAPER THAN DISPOSAL.

KOENIG, L.; FORD, D.
WATER REUSE, AMER INST CHEM ENG PROGR SYMP, SER NO 78 VOL 63, PP 143-147, 1967, 5 P, 3 FIG, 2 TAB, 14 REF.

WHEN DISPOSING OF WASTE WATER CAUSES LOSS OF VALUABLE PRODUCTS, VALUE OF WATER SUPPLIES IS HIGH, EFFLUENTS ARE STRICTLY REGULATED, POLLUTION DRAINAGES ARE EXCESSIVE, OR IF EFFLUENT QUALITY MUST BE HIGHER THAN THE QUALITY OF AVAILABLE RAW WATER, IT IS CHEAPER TO REUSE WATER THAN DISPOSE OF IT. COST CURVES SHOW THAT IF NEW WATER COSTS $5 PER THOUSAND GAL, THE COMBINED COST OF DISPOSAL AND WATER PURCHSE IS ALWAYS MORE THAN THE COST OF ANY TYPE OF REUSE PROCESSING ON ANY WASTE WATRS. COSTS OF DISPOSAL, TREATMENT, CONVEYANCE, AND REUSE PROCESSING ARE TABULATED AND SHOWN GRAPHICALLY TO PERMIT COMPARISON OF COSTS OF ALTERNATIVES. THE INFORMATION IS THE RESULT OF A PARAMETRIC COST STUDY OF EACH PROCESS TO DETERMINE COSTS, SENSITIVITY OF FINAL COSTS TO THE PARAMETERS, AND ESTIMATES OF THE USUAL VALUES OF THE PARAMETERS. FOR EXAMPLE, IT CAN BE DETERMINED THAT ANY REUSE PROCESS IS CHEAPER THAN DISPOSAL IN MINED CAVITIES, BUT DISPOSAL BY SPREADING IS CHEAPER THAN ANY REUSE. THERMAL EVAPORATION OR DEIONIZATION FROM 2,500 PPM IS MORE EXPENSIVE THAN ANY DISPOSAL, BUT THESE PROCESSES ARE CHEAPER THAN INJECTION OR TRANSPORT OF 50 MI WASTES ARE WEAKER THAN 1,500 PPM. TREATMENT FOR REUSE BY COAGULATION, FILTRATION, AND SEDIMENTATION, OR STANDARD SECONDARY SEWAGE TREATMENT, IS CHEAPER THAN INJECTION OR TRANSPORT OVER ABOUT 5 MI. (W69-8260).

00094. WASTEWATER REUSE AT THE GRAND CANYON.

GARTHE, E.C.; GILBERT, W.C.
J WATER POLLUTION CONTROL FED., 40(9), 1582-1585, 1968.

THIS PAPER TRACES WATER PROBLEMS AND WASTEWATER REUSE AT THE SOUTH RIM OF THE GRAND CANYON FROM THE LATE 1800'S TO THE PRESENT. RECLAMATION EFFORTS BEGAN IN 1924 WITH CONSTRUCTION OF AN ACTIVATED SLUDGE PLANT SUPPLEMENTED BY AN ANTHRACITE COAL FILTER AND CHLORINATION. TREATED WATER WAS USED FOR TOILETS, BOILER FEED WATER, COOLING WATER AND IRRIGATION. TREATMENT COST OF

$0.59/1000 GAL. COMPARED FAVORABLY TO RAILROAD TRANSPORTED WATER AT $3.09/1000 GAL. ADDITIONAL WATER WAS PUMPED UP FROM INDIAN GARDENS IN 1934. DETAILED RECORDS OF COST HAVE BEEN KEPT BY THE NATIONAL PARK SERVICE SINCE 1951. PRESENTLY, CONSTRUCTION OF A PIPELINE FROM ROARING SPRINGS, ON THE MORE WATER RICH NORTH RIM, PRESENTS THE POSSIBILITIES OF ABANDONING THE WATER REUSE SYSTEM, CONSTRUCTING NEWER FACILITIES, OR CONTINUING THE 40-YEAR OLD PLANT. WHATEVER THE FUTURE, THE PLANT AT GRAND CANYON HAS DEMONSTRATED THAT WASTEWATER REUSE IS AN ECONOMICALLY SOUND CONCEPT. (W69-08290).

00095. WATER REUSE IN MONTERREY, MEXICO.

GOMEZ, H.J.
J WATER POLLUTION CONTROL FED., 40(4), 540-545, 1968.

ARIDITY, AN EXTENDED DROUGHT, INDUSTRIAL DEVELOPMENT AND POPULATION EXPLOSION NECESSITATED WATER REUSE AS EARLY AS 1955. SOME INDUSTRIES TREAT AND REUSE WATER INDIVIDUALLY, WHILE OTHERS USE THE CENTRAL TREATMENT FACILITY OF A COOPERATIVE. WATER QUALITY TREATMENT VARIES WITH USE DEMANDS. USES ARE FOR WATERING GARDENS, CLEANING OF BUILDINGS AND EQUIPMENT, FIRE PROTECTION, COOLING, BOILER FEED, AND VARIOUS INDUSTRIAL PROCESSES. PRODUCTION COSTS AS WELL AS PHYSICAL AND CHEMICAL PROPERTIES OF THE WATER PRESENTED FOR EACH QAULITY USE TYPE. (W69-08289).

00096. A TEST OF THE HYPOTHESIS THAT POLLUTION CONTROL IS WORTH WHAT IT COSTS.

MINNEHAN, R. F.
PROC, WATER RESOURCES SEMINAR 1967-1968. PP 19-52 UNIV. DEL. NEWARK, DEC. 1968.

A BENEFIT-COST MATHEMATICAL MODEL WAS DEVELOPED FOR WATER QUALITY EVALUATION IN ORDER TO DETERMINE WHETHER WATER POLLUTION CONTROL IS ALWAYS WORTH WHAT IT COSTS AND WHAT IS THE OPTIMAL DEGREE OF WASTE REDUCTION. THE MODEL'S EQUATIONS WERE THEN FITTED WITH COEFFICIENTS THAT APPROXIMATED BENEFITS AND COSTS, WITH DELAWARE RIVER ESTUARY AND SAN FRANCISCO BAY AS EXAMPLES. THE RESULTS INDICATED THAT A HIGH LEVEL OF TREATMENT IS NOT JUSTIFIED WHEN THE TOTAL WASTE LOAD IS SMALL IN RELATIONSHIP TO THE ASSIMILATIVE CAPACITY OF THE STREAM OR ADJACENT WATERCOURSE. THE RESULTS ALSO INDICATED THAT ALTHOUGH COMPLETE BOD REMOVAL IS REQUIRED TO MAXIMIZE NET BENEFITS IN A HEAVILY POLLUTED RIVER, THE COSTS OF WASTE TREATMENT MAY EXCEED THE BENEFITS AND THE CONTROL PROGRAM MAY NOT BE JUSTIFIED ECONOMICALLY. AN EVALUATION OF OPTIMAL TREATMENT LEVEL REVEALED THAT THE BENEFIT COST RATIO WAS AN INCREASING AND A DECREASING FUNCTION OF BOD REMOVAL. WITH GROWTH IN THE QUANTITY OF WASTE FLOW THERE MAY BE A POINT IN TIME WHERE THE BENFITS OF POLLUTION ABATEMENT WILL ALWAYS BE LESS THAN COSTS AND OPTIMAL TREATMENT INCREASED AS THE QUANTITY OF WASTE FLOW INCREASED. (W69-08542).

00097. EUTROPHICATION.

FOEHRENBACH, J.
J WATER POLLUTION CONTROL FED., 41(6), 1029-1036, 1969.

AUTHOR REVIEWS 53 STUDIES CONTRIBUTED TO THE EUTROPHICATION LITERATURE DURING THE PERIOD 1966-1968. SUBJECT COVERAGE, WITH NUMBER OF LITERATURE CITATIONS PER SUBJECT IN PARENTHESES, ARE: USE OF FERTILIZED'WATER TO INCREASE BIOLOGICAL PRODUCTION (8) ; INDENTIFICATION OF NUTRIENTS (6); OXYGEN KINETICS (3); ALGAL CONTROL (2); SOURCES OF NITROGEN AND PHOSPHORUS (4); ROLE OF SEDIMENTS (2); RESULTS OF HUMAN CULTURAL ACTIVITIES (2); EFFECTS OF POLLUTIONAL LOAD (2); CYANOPHYTHE BLOOMS AND DECREASE IN ALGAL SPECIES DIVERSITY (2); EUTROPHICATION INDICATORS IN LAKE MICHIGAN (2); SAMPLING AND DIATOM-INDICATORS (2); NUTRIENTS, THEIR CRITICAL LEVELS AND CYCLING (4); ADVANCED WASTE TREATMENT TECHNIQUES WITH COST ESTIMATES (7); CHEMICAL TREATMENT FOR NUTRIENT REMOVAL WITH COST ESTIMATES (7). (W69-08518).

00098. A SYSTEMS ANALYSIS OF AQUATIC THERMAL POLLUTION AND ITS IMPLICATIONS: VOLUME 1, SUMMARY REPORT.

CHENEY, P.B.; SMITH, F.A.; BRUSH, R.O.; PELTON, D.J.; KANGOS, J.D.
TRAVELERS RES CORP REP NO 7743-341A, JAN 1969. 30 P.

A SYSTEMS ANALYSIS STUDY OF THERMAL DISCHARGES WAS MADE TO LEARN THE BROAD THERMAL, ENVIRONMENTAL, AND ECONOMIC EFFECTS OF RELEASING HEATED EFFLUENTS TO SURFACE WATERS. SUMMARIES ARE PRESENTED OF STEAM-ELECTRIC TECHNOLOGY, WASTE HEAT PRODUCTION, HEAT DISPOSAL METHODS, EFFECTS ON WATER BODIES OF WASTE HEAT, ECOLOGICAL EFFECTS OF WASTE HEAT, SOCIAL CONSIDERATIONS, AND COSTS OF A NUMBER OF POSSIBLE REGULATIONS OF HEAT DISPOSAL. (W69-08599).

00099. THE ECONOMICS OF CLEAN WATER.

LARDIERI, N.J.
PROC, WATER RESOURCES SEMINARS, 1967-1968, P 81-98, UNIV DEL. DECEMBER 1968.

ECONOMIC TECHNIQUES FOR ESTIMATING COSTS FOR MEETING FEDERAL WATER POLLUTION CONTROL STANDARDS AND THE POTENTIAL FOR MINIMIZING THESE COSTS BASED ON THE DELAWARE ESTUARY WERE PRESENTED. COST-BENEFIT STUDIES WERE CONDUCTED BY MUNICIPAL SOURCES AND ESTIMATES OF RECREATION, FISH AND WILDLIFE BENEFITS EXPECTED FROM THE IMPROVED LEVEL OF WATER QUALITY WERE MADE. MATHEMATICAL MODELS EMPLOYING BOTH ANALOG AND DIGITAL COMPUTERS WERE USED FOR OBTAINING TOTAL COSTS OF ATTAINING WATER QUALTIY OBJECTIVES UNDER THREE DIFFERENT REMOVAL SCHEMES NAMELY UNIFORM TREATMENT, ZONAL APPROACH AND COST MINIMIZATION. THE SUMMARY OF COST-BENEFIT DATA POINTED OUT THAT REQUIRING UNIFORM TREATMENT FROM ALL DISCHARGES IS THE MOST EXPENSIVE OF ALL SOLUTIONS, THAT INCREMENTAL BENEFITS FROM HIGHER WATER QUALITY ARE NEGLIGIBLE COMPARED TO THE COSTS REQUIRED TO ACHIEVE THEM. (W69-08548).

REFERENCE LIST

00100. A TECHNICAL AND ECONOMIC FEASIBILITY STUDY OF THE USE OF MUNICIPAL SEWAGE EFFLUENT FOR IRRIGATION.

CANTRELL, R. P.; WILSON, C.W.; BECKETT, F. .E; CALVO, F.A.
SYMPOSIUM ON MUNICIPAL SEWAGE EFFLUENT FOR IRRIGATION, JULY 30, 1968, LOUISIANA POLYTECHNIC INSTITUTE, RUSTON, LA., P 135-156, 1968.

A STUDY OF TECHNICAL AND ECONOMIC FEASIBILITY OF IRRIGATION REUSE OF RUSTON, LA. MUNICIPAL WASTE-WATER EFFLUENTS SHOW THAT THERE ARE NO SIGNIFICANT TECHNICAL PROBLEMS. NEITHER CORROSION NOR SALINITY HAZARD TO CROPS IS EXPECTED TO CAUSE SEVERE PROBLEMS. SPRINKLER IRRIGATION USING WASTE WATER IS SAFE FOR FIELD CROPS AND PASTURE BUT IS NOT RECOMMENDED FOR FRUITS AND VEGETABLES. FURROW IRRIGATION OF FRUIT TREES, AS LONG AS EFFLUENT DOES NOT CONTACT THE FRUIT, IS ACCEPTABLE. THE COST OF USING EFFLUENTS COMPARES FAVORABLE WITH COSTS OF OTHER WATER SOURCES. FOR THE FARMS STUDIED, AVERAGE ANNUAL COSTS WAS $54.82 PER ACRE, COMPARED WITH $15.87 PER ACRE FOR WELL WATER. THIS DID NOT ACCOUNT FOR THE FERTILIZER VALUE OF THE EFFLUENT, WHICH WAS ABOUT $17.50 PER ACRE-FT. (W69-08623).

00101. POLLUTION AND ENVIRONMENTAL QUALITY.

AYRES, R.U.; KNEESE, A.V.
THE QUALITY OF URBAN ENVIRONMENT: ESSAYS ON 'NEW RESOURCES' IN AN URBAN AGE, P 35-71, RESOURCES FOR THE FUTURE, INC., THE JOHNS HOPKINS PRESS, BALTIMORE, 1969.

TRADITIONALLY ENVIRONMENTAL POLLUTION HAS BEEN APPROACHED IN A FRAGMENTED WAY. AIR, WATER, AND SOLIDS POLLUTION ARE EACH DEALT WITH SEPARATELY. THIS DISCUSSIION IS ORGANIZED IN TERMS OF THE MAIN SECTORS OF THE ECONOMY WHICH PRODUCE WASTE, PARTICULARLY URBAN AREAS, AND AN ATTEMPT IS MADE TO LOOK AT THE WASTE PROBLEM IN ITS ENTIRETY. ENVIRONMENTAL POLLUTION AND ITS CONTROL IS VIEWED AS A MATERIALS BALANCE PROBLEM FOR THE ENTIRE ECONOMY. DETAILED EMPIRICAL ESTIMATES OF ACTUAL DISCHARGERS OF RESIDUALS TO THE ENVIRONMENT AND A DISCUSSION OF SOME TECHNOLOGIES FOR THEIR MODIFICATION IS GIVEN. USING SCHEMATIC RESIDUAL MATERIALS FLOW FOR THE HOUSEHOLD SECTOR, EXCLUDING AUTOMOBILES, THE INTERDEPENDENCIES OF THE VARIOUS WASTE STREAMS IS SHOWN. THE POINT IS MADE THAT OUR MARKET MECHANISM FAILS TO DEAL APPROPRIATELY WITH THE ENTIRE RESOURCES ALLOCATION PROBLEM AND DOES NOT ADEQUATELY REFLECT THE COSTS OF DISPOSING OF RESIDUAL, INCLUDING ANY COSTS TO THE OVERALL SOCIETY ASSOCIATED WITH THEIR DISCHARGE INTO THE ENVIRONMENT. TWO WAYS OF DEALING WITH THIS PROBLEM ARE GIVEN. BOTH CALL FOR INTERNALIZING THE PROBLEM TO TAKE ACCOUNT OF ALL COSTS AND BENEFITS. THE SYSTEM TO BE USED IN REORGANIZING OUR SOCIAL POLICY TO PRODUCE DIFFERENT RELATIVE BURDENS BEING PLACED ON VARIOUS RESIUAL RECEIVING ENVIRONMENTAL MEDIA IS DESCRIBED. (W69-09563).

00102. EVOLUTION OF WATER QUALITY GOALS.

BEAN, E.L.
JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 61(7), 317-320, 1969.

THE ARTICLE EVALUATES USPHS WATER QUALITY STANDARDS AND RELATES THE RISE OF NEW STANDARDS. THE RECENT WORK OF AN AWWA COMMITTE TO ESTABLISH HIGHER STANDARDS EMPHASIZES THAT WATER MUST NOT ONLY BE SAFE, BUT ALSO CLEAR, PALATABLE, NON-STAINING AND NONCORROSIVE, AND NOT TOO HARD. AWWA HAS RECOMMENDED THE COMMITTEE'S GOALS TO THE WATER INDUSTRY. THE BURDEN OF ACTION IS ON INDIVUAL WATER SUPPLIERS, WHO ARE RESPONSIBLE TO THEIR CONSUMERS. MANY CONSUMERS MAY STIFLE ATTEMPTS FOR HIGHER QUALITY WATER BECAUSE OF THE COMMON CONCEPTION OF WATER AS 'CHEAP.' WATER WORKS. MANAGEMENT, WHICH HAS EDUCATED THE PUBLIC TOWARD LOW COST, SHOULD REORIENT CONSUMERS TOWARD QUALITY AND CREATE A CUSTOMER DEMAND FOR BETTER WATER. THE AWWA COMMITTE ON WATER QUALITY GOALS HAS BEGUN A SURVEY TO DETERMINE THE FIELD STATUS OF WATER QUALITY CONTROL. OTHER RESEARCH NEEDS INCLUDE: SIMPLER TESTS TO MEASURE CORROSIVITY, TOXICS AND ORGANIC CONSTITUENTS; INSECTICIDE HAZARDS; REFINED MEASUREMENT OF EITHER ZETA OR STREAMING POTENTIALS; EFFECTS OF MINERALS ON HEALTH; REDUCTION OF SCHISTOSMIASIS; MITRATE-NITRITE DANGERS; VIRUS CONTROL; AND IMPROVED SENSORS FOR MONITORING WATER. (W69-09564).

00103. WASTE DISPOSAL COSTS OF A FLORIDA PHOSPHATE OPERATION.

BOYLE, J.R.
BUREAU OF MINES, KNOXVILLE, TENN. KNOXVILLE OFFICE OF MINERAL RESOURCES.

THE WASTE DISPOSAL METHOD USED AT THE INTERNATIONAL MINERALS AND CHEMICAL CORPORATIONS'S NORALYN PHOSPHATE OPERATIONS IN POLK COUNTY, FLA., WAS STUDIED TO DEVELOP COST ESTIMATES, PROVIDE BETTER KNOWLEDGE OF CURRENT PRACTICES, GUIDE CONSIDERATION OF ALTERNATIVE METHODS AND IDENTIFY POSSIBLE AREAS OF RESEARCH. COST ESTIMATES WERE BASED ON CAPACITIES OF EXISTING FACILITIES, BUT THE PHOSPHATE PRODUCTION AND SLIME GENERATION STATISTICS USED IN THE CALCULATIONS WERE ESTIMATES RATHER THAN DATA DRAWN FROM COMPANY RECORDS. COST ESTIMATES REPRESENT A BASIS FOR CALCULATING WASTE DISPOSAL COSTS FOR OTHER PHOSPHATE PLANTS WHICH UTILIZE THE SAME METHOD OF DISPOSAL. TOTAL OPERATING COST OF DISPOSAL IS ESTIMATED TO BE 33.0 CENTS PER TON OF PRODUCT BASED ON AN ASSUMED 4.5 MILLION TONS OF SLIME PER YEAR. NET OPERATING COST IS ESTIMATED TO BE 24.5 CENTS PER TON OF PRODUCT AFTER CREDIT OF 8.5 CENTS PER TON FOR RECIRCULATED WATER FROM THE SETTLING PONDS TO THE PLANT. TO CONSERVE MINERAL RESOURCES AND TO IMPROVE ENVIRONMENTAL CONDITIONS, RESEARCH SHOULD BE DIRECTED TO DEVELOPING ALTERNATIVES METHODS OF DISPOSAL, INCLUDING THE RECOVERY OF THE VALUES FROM THE SLIMES AND THE DEWATERING OF THE SLIMES. (GPO $0.35) (W69-07454).

00104. WHAT PRICE A QUALITY ENVIRONMENT.

CARLSON, J.W.
JOURNAL OF SOIL AND WATER CONSERVATION, 24(3), 84-88, MAY-JUNE 1969.

ATTEMPTING TO ABATE POLLUTION IMPLIES THAT ENVIRONMENTAL QUALITY GOALS HAVE BEEN ASSESSED

GOALS MUST VARY WITH COST, AND COST OF QUALITY CONTROL MUST NOT EXCEED THE DAMAGE INFLICTED. COSTS AND BENEFITS, THEN, MUST BE MEASURED. BENEFITS ARE OFTEN DIFFICULT TO MEASURE BECAUSE WE LACK ADEQUATE ENVIRONMENTAL QUALITY OR SOCIAL INDICATORS. THERE ARE PROBLEMS WITH DETERMINING THE NATURAL WELL-BEING, MEASURING AESTHETIC AND HEALTH BENEFITS, AND PROJECTING BENEFITS INTO THE FUTURE FOR FUTURE GENERATIONS. COSTS OF IMPROVEMENTS ARE EASIER TO MEASURE THAN BENEFITS, BUT ANALYSTS SHOULD BE WARY OF USING SIMPLE CALCULATION METHODS. ALL OF THE NEW DATA THAT ARE AVAILABLE MUST BE UTILIZED IN ORDER TO PREVENT INFLATED COST ESTIMATES. A RECENT FEDERAL STUDY FOUND THAT COSTS WERE MUCH LOWER THAN EXPECTED. COSTS TO INDUSTRY ARE ONLY A FRACTION OF ONE PERCENT OF THE VALUE ADDED. CONSUMERS COULD FINANCE ABATEMENT WITH A SIMILAR FRACTION OF ANNUAL INCOME. MANAGMENT OF ENVIRONMENTAL QUALITY IS EXTREMELY IMPORTANT, AND THIS CAN BEST BE DONE IF MANAGEMENT INSTITUTIONS CAN ENCOMPASS THE LOCATION WHERE THEY ORIGINATE AND CAUSE DAMAGE. (W69-09063) ALITY CONTROL.

THERMAL POLLUTION CONTROL PROBLEMS ARE DISCUSSED WITH REFERENCE TO PENDING LEGISLATION. WATER TREATMENT PROJECTS BY PUBLIC UTILITY INDUSTRIES ARE DETERRED BECAUSE OF THEIR COST WHICH IS ESTIMATED AT $1.8 BILLION DOLLARS IN 5 YEARS. THESE COMPANIES ARE FUNDING STUDIES OF WATER POLLUTION EFFECTS, HOWEVER. LARGER AND MORE CONCENTRATED HEAT LOADS ARE PREDICTED WITH SUBSTANTIATING DATA. LICENSING OF THE PLANTS MAY SOON REQUIRE COMPLIANCE WITH WATER QUALITY STANDARDS TO BE DECIDED BY STATE AGENCIES. VARIOUS COOLING FACILITIES ARE DESCRIBED WITH EXAMPLES OF EXISTING CONSTRUCTION. COST IS DEPENDENT ON THE CHOICE OF THE SYSTEM AND CANNOT BE GENERALIZED FOR COOLING LAGOONS, COOLING TOWERS, MECHANICAL DRAFT (FORCED OR INDUCED BLOWER SYSTEMS), NATURAL DRAFT. (W69-09047).

00105. DEBATE ON THERMAL ISSUE CONTINUES.

ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 3(5), 425-427, 1969.

00106. CONSERVANCY DISTRICTS (WATER QUALITY MANAGEMENT AND PROTECTION).

OHIO REV CODE ANN SECS 6101.13, 6101.15, 6101.19 (PAGE 1953), AS AMENDED, (SUPP 1970).

THE BOARD OF DIRECTORS OF CONSERVANCY DISTRICTS SHALL PREPARE PLANS FOR WATER IMPROVEMENTS FOR THEIR DISTRICTS. UNLESS REQUESTED BY THE GOVERNING BODIES OF MUNICIPAL CORPORATIONS SUCH PLANS SHALL NOT PROVIDE A WATER SUPPLY SYSTEM OR SYSTEM FOR SEWAGE DISPOSAL. THE BOARD OF DIRECTORS HAS SUPERVISORY CONTROL OVER THE IMPLEMENTATION OF PLANS IN ORDER TO ACCOMPLISH WATER QUALITY AND QUANTITY CONTROL. A BOARD MAY: ALTER ANY WATERCOURSE, DITCH, SEWER, RIVER, OR STREAM, FILL UP THE SAME AND DIVERT WATER FLOW; CONSTRUCT NECESSARY STRUCTURES FOR WATER CONTROL AND WASTE TREATMENT, AND CONSTRUCT CONNECTIONS TO WORKS FOR THE DELIVERY OF WATER SUPPLY OR SEWAGE. FOR THESE PURPOSES, A BOARD MAY ALSO ACQUIRE, SELL, OR CONTROL REAL OR PERSONAL PROPERTY. A BOARD MAY MAKE SUCH REGULATIONS AS ARE NECESSARY TO PROTECT IMPROVEMENT IN CONSERVANCY DISTRICTS. IT MAY PRESCRIBE REGULATIONS FOR CONSTRUCTION OF STRUCTURES, THE CONNECTION OF SEWERS, DITCHES OR PIPELINES WITH THE WORKS OF A DISTRICT, THE PERMISSIBLE USES OF THE WATER SUPPLY, AND THE DISCHARGE OF LIQUID AND SOLID WASTES INTO SEWERS. PERSONS VIOLATING SUCH REGULATIONS SHALL BE LIABLE FOR THEIR DAMAGE. (W69-03644).

00107. MATHEMATICAL MODEL OF SEWAGE SLUDGE FLUIDIZED BED INCINERATOR CAPACITIES AND COSTS.

DUCAR, G.J.; LEVIN, P.

FWPCA OHIO BASIN REGION, ROBERT A TAFT WATER RESEARCH CENTER, REPORT TWRC-10, ADVANCED WASTE TREATMENT RESEARCH LABORATORY, CINCINNATI, OHIO SEPT 1969. 72 P.

THE DEVELOPMENT OF A COMPUTER PROGRAM TO EVALUATE SEWAGE SLUDGE FLUIDIZED BED INCINERATION SYSTEMS IS DESCRIBED. DATA FOR THE PROGRAM WAS COLLECTED FROM MANUFACTURERS, A LITERATURE SURVEY AND FIELD TRIPS TO OPERATING INSTALLATIONS. MOST OF THE DATA OBTAINED FROM THE FIELD BECAUSE OF THE LACK OF AVAILABLE INFORMATION FROM THE OTHER SOURCES. MORE THAN FIFTY CORRELATION RELATIONSHIPS WERE ATTEMPTED BEFORE THE NECESSARY DATA COULD BE REASONABLY REPRESENTED. EQUATIONS WERE DEVEOPED FOR THE LEAST SQUARE CURVES WHICH FITTED THE DATA BEST. THESE EQUATIONS WERE USED AS THE BASIS FOR THE COMPUTER PROGRAM DEVELOPED TO SIZE SOME OF THE MAJOR COMPONENTS AND TO ESTIMATE CAPITAL, OPERATING AND MAINTENANCE COSTS FOR THE FLUDIZED BED INCINERATION SYSTEM. (PB-189 295) (W70-03610).

00108. WATER DEVELOPMENT AUTHORITY.

OHIO REV CODE ANN SECS 6121.01 THRU 6121.05 (PAGE SUPP 1970).

VARIOUS TERMS RELATED TO WATER RESOURCES AND WATER CONSERVATION IN OHIO ARE DEFINED INCLUDING: BENEFICIAL USE, WATERS OF THE STATE, WATER RESOURCES, WATER DEVELOPMENT PROJECT, POLLUTION, INDUSTRIAL WASTE, WASTE WATER, WASTE AND WATER MANAGMENT FACILITIES. IT IS THE STATE POLICY OF OHIO TO CONSERVE, DEVELOP, UTILIZE AND MAINTAIN ITS WATER RESOURCES, TO PREVENT OR ABATE WATER POLLUTION, AND TO PROMOTE THE BENEFICIAL USE OF STATE WATERS. PURSUANT TO THIS POLICY, THE OHIO WATER DEVELOPMENT AUTHORITY IS CREATED. THE AUTHORITY MAY MAKE LOANS OR GRANTS TO GOVERNMENTAL AGENCIES FOR THE ACQUISITION OR CONSTRUCTION OF WATER DEVELOPMENT PROJECTS. IT MAY ESTABLISH RULES AND REGULATION FOR USE OF WATER DEVELOPMENT PROJECTS. IT MAY ALSO ESTABLISH RULES AND REGULATIONS TO PROTECT AUGMENTED FLOW IN STATE WATERS BROUGHT ABOUT BY AUGMENTED FLOW. METHODS OF FINANCING, OPERATIONS, AND SUPERVISION OF WATER DEVELOPMENT PROJECTS ARE DESCRIBED. THE AUTHORITY MAY ENGAGE IN RESEARCH AND DEVELOPMENT WITH RESPECT TO WASTE WATER AND WATER MANAGEMENT FACILITIES. (W70-03575).

00109. ACQUISITION OF LAND TO PREVENT CONTAMINATION.

PA STAT ANN TIT 53, SEC 2992 (1957).

ANY MUNICIPALITY, EXCEPT THIRD CLASS CITIES, MAY ACQUIRE AND HOLD LANDS WHICH ARE CONTIGUOUS TO STREAMS OR RESERVOIRS FROM WHICH WATER IS TAKEN FOR PUBLIC USE WHEN IT IS NECESSARY TO PRESERVE THE RESERVOIRS FROM CONTAMINATION. THESE LANDS MAY BE ACQUIRED BY PURCHASE OR CONDEMNATION.

NO LAND, HOWEVER, SHALL BE TAKEN UNTIL JUST COMPENSATION HAS BEEN MADE FOR PROPERTY TAKEN, UNJURED, OR DESTROYED. (W70-03532)

00110. CURRENT PRACTICE IN POTATO PROCESSING WASTE TREATMENT.

GUTTORMSEN, K, CARLSON, D.A.
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION RESEARCH SERIES REPORT DAST-14, OCT 1969. 109 P.

POTATO PROCESSING, WASTE TREATMENT, AND CURRENT AND NEEDED RESEARCH IN WATER QUALITY CONTROL IN THIS PRODUCTION FIELD ARE DISCUSSED. A BRIEF DISCRIPTION IS GIVEN OF GENERAL CHARACTERISTICS OF THE POTATO AND THE EFFECTS AND IMPORTANCE OF CULTURAL AND ENVIRONMENTAL CONDITIONS ON POTATO PROCESSING. GENERAL DESCRIPTIONS OF THE PRODUCTION PROCESSES ARE INCLUDED AND THE LITERATURE IS EXTENSIVELY REVIEWED TO PRESENT CURRENT AND PROPOSED WASTE TREATMENT TECHNOLOGY. THE MOST URGENT RESEARCH NEEDS ARE DISCUSSED TOGETHER WITH SUGGESTED METHODS FOR MEETING THESE NEEDS (PB-189 232) (W70-03433).

00111. FOAM SEPARATION OF KRAFT PULPING WASTES.

FWPCA WATER POLLUTION CONTROL RESEARCH SERIES, DAST-3, OCT 1969. 81 P.

LABORATORY STUDIES OF FOAM SEPARATION WERE CONDUCTED TO DETERMINE THE FEASIBILITY OF THIS PROCESS FOR REDUCING B. O. D., SOLIDS CONTENT, AND FOAMING TENDENCY OF CLARIFIED KRAFT MILL EFFLUENT. SINCE KRAFT PULPING WASTES HAVE A NATURAL TENDENCY TO FOAM, IT WAS EXPECTED THAT THE FOAMING PROCESS, WHICH HAS BEEN FOUND TO BE USEFUL IN TREATING DOMESTIC WASTES, MIGHT HAVE APPLICATIONS IN TREATMENT OF THESE EFFLUENTS. BOTH CONTINUOUS FLOW AND BATCH EXPERIMENTS WERE CONDUCTED, AND LIQUID AND FOAM HEIGHTS, LIQUID FEED RATES, AIR SPARGING RATES, AND TEMPERATURE WERE VARIED OVER WIDE RANGES. THE B. O. D. REDUCTION IN THE TREATED LIQUID WAS DISAPPOINTIING SMALL, AVERAGING LESS THAN 5 PER CENT, AND THE B. O. D. ENRICHMENT IN THE FOAM PHASE WAS IN MOST CASES LESS THAN 1.5 TIMES THAT OF THE FEED. SOLIDS REMOVAL WAS CORRESPONDINGLY LOW. FOAMING TENDENCY, HOWEVER, WAS SIGNIFICANTLY REDUCED BY THE INTENTIONAL FOAMING PROCESS WITH REDUCTIONS OF 40 TO 60 PER CENT IN THIS VARIABLE BEING OBTAINED. THE REDUCTION IN FOAMING TENDENCY WAS A STRONG FUNCTION OF GAS-TO-LIQUID RATIO WITH THE MOST EFFECTIVE OPERATING RANGE BEING BETWEEN 1.0 AND 1.5 SCFM/GALLON. THE EXPERIMENTAL RESULTS SUGGEST THAT THE REDUCTIONS IN B. O. D. AND FOAMING TENDENCY WERE RELATED TO THE SEPARATION OF THE TALL OIL COMPONENTS OF THE WASTE. THESE COMPONENTS WERE CONCENTRATED IN THE FOAM FRACTION, BUT THEY ACCOUNT FOR A MAXIMUM OF ONLY 10 TO 12 PER CENT OF THE B. O. D. OF THE RAW FEED. APPARENTLY THE REMAINING B. O. D. -PRODUCING MATERIALS WERE NOT SURFACE ACTIVE AND DID NOT ATTACH THEMSELVES TO THE SURFACE-ACTIVE COMPONENTS. THE COST OF USING A FOAM PROCESS ON KRAFT MILL WASTES IS ESTIMATED TO BE FOUR TO FIVE PER CENT PER 1000 GALLONS OF FEED. THIS COST IS EXCLUSIVE OF FURTHER PROCESSING OF THE CONCENTRATED FOAMATE. BASED ON CONTROL OF FOAMING TENDENCY ALONE, THE PROCESS WOULD BE UNATTRACTIVE FROM A COST STANDPOINT. (PB-189 160) (W70-03350)

00112. THE ECONOMICS OF REGIONAL WATER QUALITY MANAGEMENT.

KNEESE, A.V.
BALTIMORE, JOHNS HOPKINS PRESS, 1964. 215 P.

THIS BOOK IS DESIGNED TO SHED LIGHT ON HOW TO DETERMINE ECONOMICALLY OPTIMAL REGIONAL SYSTEMS FOR MANAGING WATER QUALITY AND HOW TO DEVISE APPROPRIATE INSTITUTIONAL FORMS AND TOOLS FOR MANAGEMENT OF WATER QUALITY. TO ACHEIVE THIS PURPOSE, BOTH THE ECONOMIC THEORY OF RESOURCES ALLOCATION AND CASE STUDIES OF ACTUAL SITUATIONS ARE USED. AN INTRODUCTION TO THE SCIENTIFIC AND TECHNOLOGICAL ASPECTS OF WATER QUALITY IS INCLUDED, FOLLOWED BY THE IDENTIFICATION OF MAJOR WASTE MATERIALS ENTERING WATERCOURSES AND METHODS OF TREATING BOTH WASTE WATER AND WATER SUPPLIES. FOLLOWING THIS DISCUSSION IS AN OUTLINE OF THE ECONOMIC RESOURCES ALLOCATION THEORY AS RELATED SPECIFICALLY TO WASTE DISPOSAL PROBLEMS, AND ESPECIALLY THAT OF WATER POLLUTION. THE CRITERIA OF COST ASSESSMENT AND REDISTRIBUTION ARE APPLIED TO THE WATER QUALITY PROBLEM IN THE OHIO BASIN. REGIONAL WASTE DISPOSAL SYSTEMS ARE THEN DISCUSSED AS WATER QUALITY CONTROL SYSTEMS WHICH ARE PART OF GENERAL WATER RESOURCES MANAGEMENT AND MUST BE PLANNED ACCORDINGLY. THE RUHR AREA OF WEST GERMANY IS STUDIED IN THIS RESPECT, PREVIOUS TO A SURVEY OF THE IMPLICATIONS OF THIS AREA ON PRESNET AND FUTURE POLICY-MAKING. (W69-08981)

00113. POLLUTION CHARGES, WASTE ASSIMILATIVE CAPACITY INVESTMENT, AND WATER QUALITY: THE PUBLIC COSTS OF A PUBLIC GOOD.

BOYD, J.H.
OHIO STATE UNIV WATER RESOURCES CENTER REP. JAN 1969. 89 P.

A SYSTEM ANALYSIS STUDY WAS MADE OF THE RELATIONSHIP BETWEEN POLLUTION-CHARGE TAX INCOME AND THE COSTS OF AUGMENTATION OF WASTE ASSIMILATIVE CAPACITY, WITH BOTH SET TO MAXIMIZE BENEFITS TO RIVERS. PARAMETRIC COST FUNCTIONS FOR SEVERAL WASTE TREATMENT TECHNOLOGIES ARE DERIVED. IT IS CONCLUDED THAT LOW-FLOW AUGMENTATION COUPLED WITH OPTIMAL-LEVEL POLLUTION CHARGES WILL PROBABLY GENERATE SUBSTANTIAL FINANCIAL SURPLUSES, WHILE ARTIFICIAL AERATION WILL PROBABLY BREAK EVEN OR GENERATE A SMALL DEFICIT. (W69-08751)

00114. THE SCIENTIST'S RESPONSIBILITY IN THE CONTROL OF MAN'S ENVIRONMENT.

HOLIFIELD, C.
PROC 2ND NATL SYMP ON RADIOECOLOGY, MAY 15-17, 1967, ANN ARBOR, MICH. US ATOMIC ENERGY COMM, DOC CONF 670503, P 1-8.

AUTHOR DISCUSSES ECOLOGICAL ISSUES, ESPECIALLY EFFECTS OF NUCLEAR EXPLOSIVES ON ECOSYSTEMS FROM PANAMA CANAL TO NORTHERN COASTS OF ALASKA AND EFFECTS OF FALLOUT-THE ESKIMO'S PROBLEM OF BODY BURDEN ACCUMULATIONS VIA FOOD CHAIN. PEACEFUL APPLICATIONS OF NUCLEAR EXPLOSIVES DEMAND CONSULTATION WITH ECOLOGIST. URANIUM MINERS' EXPOSURE TO RADIATION STILL REQUIRES SOLUTIONS. CITIZENS' REVOLT AGAINST POLLUTION OF THEIR ENVIRONMENT DEMANDS CORRECTIVE ACTION. DATA AFFECTING HEALTH AND WELFARE MUST BE OBTAINED

REMEDIAL ACTION IS BEING SLOWLY INSTIGATED. ADMINISTRATORS USING RESULTS OF RESEARCH MUST USE THEM PROPERLY AS IMPROPER IMPRESSIONS OF CONCLUSIONS MAY LEAD TO UNSUITABLE DECISIONS BY LAYMEN. LOW COST ENERGY FROM NUCLEAR POWER PLANTS CAN BE USED TO PURIFY AND RECLAIM WATER SUPPLIES. GIVEN THIS CLEAN ENERGY IN ABUNDANCE, RAILROADS COULD BE ELECTRIFIED, SEWAGE PASTERIZED, CITIES CENTRALLY HEATED AND REFRIGERATED. ENERGY SHOULD BE CONSIDERED MORE IN URBAN PLANNING, EVEN THE LOCATION OF REACTORS IN THE HEART OF CITIES. ALTHOUGH QUANTITIES OF NUCLEAR WASTE WOULD HAVE TO BE STORED, TECHNIQUES ARE NOW BEING REFINED FOR DISPOSAL, INCLUDING STORAGE IN SALT MINES. (CONF 670 503) (W69-08683).

00115. DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS.

WATER POLLUTION CONTROL SERIES, FWPCA REPORT ORD-2, AUG. 1969. 184 P.

THIS REPORT IS AN INTENSIVE STUDY OF THE DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS. THE WASTES INCLUDE FILTER WASHWATER, SLUDGE RESULTING FROM COAGULATION, SOFTENING, IRON AND MANGANESE REMOVAL PROCESSES, DIATOMACEOUS EARTH FILTRATION, AND ION EXCHANGE BRINES. THE CONTROL OF POLLUTION FROM THESE WASTES IS A HIGH PRIORITY PROBLEM FOR THE WATER UTILITY INDUSTRY. A SERIES OF FOUR STATUS REPORTS DESCRIBE IN DETAIL WHAT IS KNOWN OF THE RESEARCH, ENGINEERING, PLANT OPERATION, AND REGULATORY ASPECTS OF THE PROBLEM. A SPECIAL REPORT REVIEWS CURRENT TECHNOLOGY AND ANALYZES COSTS OF DISPOSAL METHODS, BASED ON DATA COLLECTED FROM FIFTEEN OPERATING PLANTS. A CONFERENCE WAS ORGANIZED TO PROVIDE EXPERT EVALUATION OF EACH REPORT AND TO EXTEND THE DATA AVAILABLE. FINAL REPORTS WERE PREPARED BY COMMITTEES OF CONFERENCE PARTICIPANTS TO IDENTIFY FUTURE NEEDS FOR INFORMATION IN EACH ASPECT OF THE WASTE DISPOSAL PROBLEM. THESE REPORTS RECOMMEND SUBSTANTIALLY EXPANDED PROGRAMS OF RESEARCH AND DEMONSTRATION. THEY INCLUDE EXTENSIVE LISTS OF SPECIFIC PROBLEMS WHICH MUST BE INVESTIGATED TO DEVELOP EFFECTIVE AND ECONOMICAL TECHNOLOGY. COMMITTEE REPORTS ALSO RECOMMEND ESTALISHMENT OF A CENTRAL SERVICE TO PROMOTE THE PLANNING OF RESEARCH AND DEVELOPMENT, AND TO IMPLEMENT EFFECTIVE PROGRAMS OF NEW OR IMPROVED TECHNOLOGY. THE SERVICE WOULD COLLECT, COORDINATE, AND DISSEMINATE DATA ON ALL ASPECTS OF WATER TREATMENT PLANT WASTE DISPOSAL PROBLEMS. (PB-186 157) (W70-00162).

00116. ECONOMIC EFFECTS OF USING SUBSTANDARD QUALITY WATER IN WEBSTER AND OTHER COMMUNITIES IN SOUTH DAKOTA.

OFFICE OF SALINE WATER RESEARCH AND DEVELOPMENT PROGRESS REPORT NO 463, OCT 30, 1969. 192 P.

WEBSTER, S. D., (POPULATION 2,500) WAS ONE OF THE FIVE SITES CHOSEN BY THE OFFICE OF SALINE WATER FOR THE CONSTRUCTION OF A DESALINATION DEMONSTRATION PLANT. SINCE 1962, WEBSTER'S MUNICIPAL WATER SUPPLY HAS BEEN PRIMARILY MADE UP OF THE PRODUCT WATER FROM 250000 GPD ELECTRODIALYSIS FACILITY. THE PURPOSE OF THE STUDY WAS TO COMPARE THE MUNICIPAL USE TO THE WATER BEFORE AND AFTER THE CHANGEOVER FROM BRACKISH WATER TO A MUNICIPAL SUPPLY OF REDUCED MINERAL CONTENT. MORE SPECIFIC OBJECTIVES WERE TO COMPUTE IDENTIFIABLE COST ITEMS RELATED TO THE USE OF CENTRALLY SOFTENED BRACKISH WATER VERSUS THE USE OF DEMINERALIZED WATER. REPLACEMENT COSTS WERE SHARPLY REDUCED FOR HOT WATER HEATERS INSTALLED AFTER 1962. FIFTEEN OTHER S. D. COMMUNITIES WERE LIKEWISE SURVEYED. AGREEMENT AMONG USERS WAS NOT CLEARLY UNANIMOUS. TO THE NATIVE HOUSEWIFE SOFTNESS WAS MORE IMPORTANT THAN GENERALLY LOW MINERAL CONTENT. INSTITUTIONAL AND COMMERCIAL USERS DISTINCTLY PREFFERRED THE DEMINERALIZED WATER. (W70-00272).

00117. RESEARCH GOALS AND PROGRESS TOWARD THEM.

KNEESE, A.V.

ENVIRONMENTAL QUALITY IN A GROWING ECONOMY, BALTIMORE, THE JOHNS HOPKINS PRESS, P 69-87, 1966.

THE ARTICLE IS CONCERNED WITH THE USEFUL STUDY OF ENVIRONMENTAL QUALITY PROBLEMS. ECONOMIC STUDIES OF THESE PROBLEMS FALL INTO FOUR CATEGORIES: CONCEPTUAL AND METHODOLOGICAL STUDIES, EMPIRICAL EVALUATION STUDIES, CONTROL SYSTEMS STUDIES, AND STUDIES BEARING UPON DESIRABLE INSTITUTIONAL CHANGE. KNOWLEDGE OF THE ECONOMICS OF ALTERNATIVE SYSTEMS OF MANAGEMENT WHEN COMBINED WITH TECHNICAL KNOWLEDGE CAN BE THE BASIS FOR GREAT OPPORTUNITIES FOR RESEARCH AND CONSTRUCTIVE INNOVATIONS IN THE AREAS OF POLITICS, LAW, AND ADMINISTRATIVE ORGANIZATIONS. IN ECONOMIC STUDIES, OPTIMUM RULES, STANDARDS, OR OTHER TECHNIQUES FOR CONTROLLING ENVIRONMENTAL QUALITY MUST RESULT FROM ANALYSIS OF VALUES. IF, AS OFTEN HAPPENS, SUCH VALUE-BASED RULES CANNOT ACHIEVE OPTIMAL ENVIRONMENTAL QUALITY MANAGEMENT, MORE DIRECT AND EXPLICIT COLLECTIVE ACTION ON A REGIONAL SCALE IS INDICATED. FINALLY, APPROPRIATE RESEARCH ON HOW TO DESIGN SUITABLE INSTITUTIONAL AND ORGANIZATIONAL ARRANGEMENTS IS NEEDED TO IMPLEMENT MANAGEMENT SYSTEMS AND PROCEDURES SUGGESTED BY ECONOMIC AND ENGINEERING ANALYSIS. THIS ARTICLE IS OF INTEREST TO THE WATER RESOURCE RESEARCHER DUE TO THE KEY ROLE HE PLAYS IN THIS ECONOMIC ANALYSIS OF THE ENVIRONMENT AND ALSO DUE TO THE EXTENSIVE USE OF WATER RESOURCE STUDIES IN THE PLANNING PROCESS. (W70-00619).

00118. COMMENT ON ECONOMY OF WATER QUALITY MANAGEMENT AND POLLUTION CONTROL. (REMARKS BY FALKSON).

FALKSON, L.M.

IN THE FRESH WATER OF NEW YORK STATE: ITS CONSERVATION AND USE, P 58-60, WM C BROWN BOOK CO, DUBUQUE, IOWA, 1967.

NON-ECONOMISTS IN THE WATER POLLUTION CONTROL FIELD TEND TO LOOK FOR ANSWERS FROM THE ECONOMISTS, OR SOME SORT OF JUSTIFICATION FOR DECISIONS WHICH HAVE ALREADY BEEN MADE. THE ECONOMIST'S MAJOR POTENTIAL CONTRIBUTION IS THE CONCEPTUAL FRAMEWORK WHICH HE CAN PROVIDE FOR ANALYZING THE PROBLEM OF WATER POLLUTION. THE CONCEPT OF OPTIMIZATION IS A RECURRENT AND BASIC ECONOMIC PROBLEM. HOWEVER, UNTIL BENEFIT FUNCTIONS FOR WATER QUALITY ARE ESTIMATED, THE ECONOMIST'S OPTIMIZATION MODEL CANNOT BE APPLIED. IF A SEOND BEST SOLUTION IS SOUGHT IN WHICH CERTAIN PREDETERMINED STREAM STANDARDS ARE MET AT LEAST COST VALUES, A SYSTEM OF EFFLUENT CHARGES COULD ACHIEVE THE SAME RESULT AND AT CONSIDERABLY LESS ADMINISTRATIVE COST THAN EXISTING PRACTICES. HOWEVER, EFFLUENT CHARGES ARE NOT EN-

TIRELY ACCEPTABLE AND THE ECONOMIST'S ALTERNATIVE SOLUTIONS TO THE PROBLEM ARE NEEDED. (W70-00613).

00119. COST OF MUNICIPAL SEWAGE TREATMENT.

ACKERMAN, W.C.
TECHNICAL LETTER 12, ILLINOIS STATE WATER SURVEY, JUNE 1969. 12 P.

ESTIMATING THE COSTS OF CONSTRUCTING AND OPERATING A MUNICIPAL SEWAGE TREATMENT FACILITY ARE POSSIBLE FROM THE DATA GIVEN. SUCH COSTS MAY BE ESTIMATED FROM THE REGRESSION LINES OF THE FIGURES INCLUDED, CONFIDENCE INTERVALS OF THE BEST FIT LINES OF REGRESSION ARE GIVEN SUCH THAT THE ESTIMATES ARE CORRECT 16 PERCENTOF THE TIME. CONSTRUCTION COSTS ARE INDEXED, THE BASE OF THE INDEX DEPENDED ON GEOGRAPHICAL LOCATION. A TABLE IS INCLUDED TO FACILIATATE COMPARISON OF CONSTRUCTION COSTS. ANNUAL UNIT OPERATING COSTS IN TERMS OF DOLLARS PER POPULATION EQUIVALENT OF WASTES TREATED ARE PRESENTED. ALSO INCLUDED IS THE COST OF LAND WHICH REPRESENTS A SIGNIFICANT PROPORTION OF CAPITAL INVESTMENT FOR LAGOON CONSTRUCTION. FINALLY, A TREND LINE OF THE CONSTRUCTION COST INDICES IS GIVEN SO THAT THE FORECASTS MAY BE MADE. AN EXAMPLE IS WORKED OUT TO DEMONSTRATE HOW TO UTILIZE THE DATA IN ESTIMATING COSTS. (W70-00493).

00120. EXTERNALITIES AND THE QUALITY OF AIR AND WATER.

DAVIS, O.A.; KAMIEN, M.I.
VIRGINIA WATER RESOURCES RESEARCH CENTER, VIRGINIA POLYTECHNIC INSTITUTE, SHORT SOURCE, P 15-20, APR 28-30, 1969. 15 P.

THE COSTS AND BENEFITS ASSOCIATED WITH ANY DESIRED LEVEL OF AIR AND WATER QUALITY IN THE CONTEXT OF MODERN ECONOMIC CONCEPTS ARE EXPLAINED. IN THE ALLOCATION OF RESOURCES, SUCH AS AIR AND WATER, OPPORTUNITY OR REAL COSTS ARE INCURRED. THE CITERION OF BEST ALLOCATION IS PARETO OPTIMALITY WHICH ASSERTS THAT AN ALLOCATION OF RESOURCES IS OPTIMAL IF NO REALLOCATION COULD MAKE SOME MEMBERS OF SOCIETY BETTER OFF WITHOUT MAKING OTHERS WORSE OFF. WHAT SHOULD BE PRODUCED AND HOW MUCH ARE QUESTIONS NOT ANSWERED BY PARETO OPTIMALITY, BUT BY VALUE JUDGEMENTS AS TRANSMITTED THROUGH POLITICAL PROCESSES. THE MARKET MECHANISM ALLOCATES RESOURCES WHICH ARE COMPATIBLE WITH CONSUMER SOVEREIGNTY. PERFECT COMPETITION LEADS TO A PARETO OPTIMALITY EQUILIBRIUM MIX OF COMMODITIES. PECUNIARY EXTERNALITIES EXISTS WHEN THE BUYING DECISION OF AN INDIVIDUAL AFFECTS PRICE. TECHNOLOGICAL EXTERNALITIES EXIST WHEN ONE DECISION UNIT AFFECTS THE DECISIONS OF OTHER UNITS. EXAMPLES OF BOTH TYPES OF EXTERNALITIES ARE GIVEN. (W70-00490).

00121. EFFLUENT CHARGES.

RUSSEL, C.S.
VIRGINIA WATER RESOURCES RESEARCH CENTER, VIRGINIA POLYTEHCHNIC INSTITUTE, SHORT COURSE, P 51-73, APR 28-30, 1969. 23 P.

ECONOMISTS ARE INTERESTED IN EFFLUENT CHARGES FOR THEY ARE INTERESTED IN THE MANNER IN WHICH MARKET PRICES LINK THE COMPLEX SYSTEM OF RESOURCE ALLOCATION. A THEORETICAL EXAMINATION OF THE ROLE OF MARKET PRICES AND THE AFFECT ON EFFLUENT CHARGES IS GIVEN. TO ILLUSTRATE HOW MARKET PRICES AFFECTS EFFLUENT CHARGES A SIMPLE, ILLUSTRATIVE CASE IS EXPLORED. THE CONDITIONS OF OPTIMAL WASTE REMOVAL ARE ILLUSTRATED. COST FUNCTIONS, INCLUDING TOTAL, AVERAGE, AND MARGINAL COSTS, ARE UTILIZED IN THE DISCUSSION. IN APPLYING A SYSTEM OF EFFLUENT CHARGES A WATER MANAGER IS FACED WITH INSTITUTIONAL, POLITICA, TECHNOLOGICAL, AND ECONOMIC PROBLEMS. SUCH PROBLEMS ARE DISCUSSED. EFFLUENT CHARGES ARE USEFUL IN THE ADMINISTRATION OF SCHEMES BASED ON STREAM STANDARDS. (W70-00489).

00122. COST-BENEFIT ANALYSIS: SELECTED ISSUES.

MCKEAN, R.N.
VIRGINIA WATER RESOURCES RESEARCH CENTER, VIRGINIA POLYTECHNIC INSTITUTE, SHORT COURSE, P 134-146, APR 28-30, 1969.

THE PROBLEM IN COST-BENEFIT ANALYSIS IS THE VALUATION OF INPUTS AND OUTPUTS OF A PROPOSAL. SUBJECTIVE BENEFITS ARE THE SPILL OVER BENEFITS OR EXTERNALITIES OF A PROJECT, I.E. BENEFICIAL CONSEQUENCES THAT DO NOT PASS THROUGH A MARKET AND FOR WHICH THERE IS NO DIRECT EVIDENCE REGARDING HOW MUCH PEOPLE ARE WILLING TO PAY FOR THEM. POSSIBLE WAYS OF MEASURING AESTHETIC VALUES ARE: COMPARING VALUES OF PROJECTS THAT DO CONTAIN CERTAIN AESTHETIC CHARACTERSTICS WITH THOSE PROJECTS THAT DO NOT, CONSULT AN EXPERT PANEL. RECREATIONAL SERVICES ARE ALSO SUBJECTIVE BENEFITS, AND ONE METHOD OF EVALUATING SUCH SERVICES IS TO ESTIMATE DIFFERENCES IN THE AMOUNTS PEOPLE ARE WILLING TO SPEND FOR TRAVEL TO AND FROM THE FACILITY. COSTS INFLICTED ON OTHERS THAT DO NOT PASS THROUGH ANY MARKET ARE THEREFORE NOT VOLUNTARILY ACCEPTED BECAUSE OF AN EXCHANGE. SUCH COSTS ARE DIFFICULT TO EVALUATE. THE VALUE OF THESE SOCIAL BENEFIT AND COSTS DEPEND ON THE WELFARE CRITIERION ACCEPTED BY SOCIETY. (W70-00487).

00123. ECONOMICS OF AIR AND WATER POLLUTION.

VIRGINIA WATER RESOURCES RESEARCH CENTER, VIRGINIA POLYTECHNIC INSTITUTE, SHORT COURSE, APR 28-30, 1969. 303 P.

THIS PUBLICATION CONTAINS 17 ARTICLES, SIX OF WHICH DEAL WITH DIFFERENT ASPECTS OF WATER POLLUTION. THE AREAS COVERED ARE: EXTERNALITIES AND WATER QUALITY; PUBLIC VERSUS PRIVATE GOODS; EFFLUENT CHANGES; WASTE ABATEMENT AND U. S. SUBSIDIES, SELECTED ISSUES OF COST-BENEFIT ANALYSIS, AND, THE MEASUREMENT OF ECONOMIC LOSSES FROM UNCOMPENSATED EXTERNALITIES. ONE APPENDIX LISTS THE PARTICIPANTS IN THE THREE DAY SHORT COURSE AND THE SECOND APPENDIX LISTS THE BIOGRAPHICAL INFORMATION OF THE SPEAKERS. (W70-00486).

00124. REDUCING LAND SUBSIDENCE IN THE WILMINGTON OIL FIELD BY THE USE OF SALINE WATERS.

PIERCE, R.L.
PROC AMER GEOPHYS UNION MEETING, APR 21-25, 1969. PAPER H-68.

THE SUBSIDENCE AT LONG BEACH, CALIFORNIA ATTRIBUTED TO THE WILMINGTON OIL FIELD DEVELOPMENT ENCOMPASSED AN AREA OF 22 SQ MI. SUBSIDENCE RANGED FROM 2 FT TO 30 FT, BUT THE OIL FIELD IS FAR

TIALLY IN THE TIDELANDS OF LONG BEACH, CALIFORNIA, AND THE PACIFIC OCEAN PROVIDED A CONVENIENT SUPPLY OF SALINE WATER NECESSARY TO CORRECT SUBSIDENCE BY INJECTION OF SEA WATER. THE INJECTION OF SALINE WATER SUCCESSFULLY STOPPED THE LONG BEACH HARBOUR AREA SUBSIDENCE. BY 1968, 2.1 BILLION BARRELS OF SALINE WATER WERE INJECTED IN TO THE WILMINGTON OIL FIELD. THE BULK OF THIS OCEAN PRODUCED FROM SOURCE WELLS OPEN TO SANDS 200 FT TO 400 FT DEEP. THE CURRENT INJECTION RATE OF THE FIELD IS 1.1 MILLION BARRELS PER DAY. EXPANDED USE OF THE OIL FIELD'S PRODUCED BRINE FOR INJECTION IS TAKING PLACE AND 550,000 BARRELS PER DAY OF THIS BRINE WILL REPLACE SOURCE WELL WATER DURING 1969. THE METHOD BEING USED TO CLEAN THE OIL FIELD'S PRODUCED BRINE INCLUDE: (1) FILTRATION, (2) RECYCLING THROUGH THE SHALLOW SOURCE WATER BEDS, AND (3) BLENDING WITH FRESH OR OTHER SALINE WATERS. (W70-00447).

00125. COMBATING POLLUTION CREATED BY OIL SPILLS, VOLUME I: METHODS.

PASTHUHOV, S.S.; GRAY, S.S.; WECHSLER, A. .E.
US COAST GUARD, JUNE, 08 1969. 151 P.

OF PRIMARY INTEREST TO THE PROFESSIONAL, THIS STUDY PROVIDES INFORMATION ON THE STATE-OF-THE-ART OF AVAILABLE METHODS FOR COMBATING OIL SPILLS, ALONG WITH THEIR BASIC TECHNOLOGY. IT RATES THE EFFECTIVENESS OF EACH METHOD ON THE BASIS OF TECHNICAL, ECOLOGICAL, AND OPERATIONAL CONSIDERATIONS AND PRESENTS QUALITATIVE COST INFORMATION ASSOCIATED WITH ACTUAL OIL SPILL CLEANUP OPERATIONS. DISCUSSED ARE MECHANICAL REMOVAL, PHYSICAL SINKING METHODS, CHEMICAL DISPERSION, PHYSICAL ABSORPTION, COMBUSTION, BIOLOGICAL DEGRADATION. BECAUSE OF THE UNDEVELOPED STATE OF THE ART OF THE VARIOUS COMBATANT METHODS, THE INDICATED COSTS IN THE COST ANALYSIS ARE NOT SO MUCH QUANTITATIVE MEASURES AS THEY ARE COMPARATIVE ONES. (AD-696 635) (W70-02744).

00126. DELAWARE RIVER BASIN COMMISSION ANNUAL REPORT 1969.

DELAWARE RIVER BASIN COMMISSION, TRENTON, NJ, 08663, 1969. 21 P.

THIS IS THE ANNUAL REPORT OF THE ONLY INTERSTATE-FEDERAL ORGANIZATION COVERING THE FULL RANGE OF WATER MANANGEMENT IN THE UNITED STATES. THE ECONOMIC SIGNIFICANCE OF THE REPORT RELATES MOSTLY TO WATER QUALITY CONTROL. THE COMMISSION FIRST ADOPTED RIVER QUALITY STANDARDS SIMILAR TO THOSE IMPOSED ELSEWHERE. IT WAS THEN ESTIMATED THAT THIS REQUIRED A REDUCTION BY TWO-THIRDS OF THE OXYGEN-CONSUMING WASTES ENTERING THE ESTUARY. THIS TOTAL WAS THEN SUBDIVIDED INTO FOUR ZONES, SINCE IT WAS FOUND THAT ECONOMIC EFFICIENCY WOULD NOT BE SERVED BY SIMILAR TREATMENT OF ALL ZONES. DURING 1969 AN ALLOTMENT WAS MADE TO EACH INDUSTRIAL AND MUNICIPAL TREATMENT PLANT OF ITS MAXIMUM CONTRIBUTION TO THE TOTAL LOAD. THIS TRANSPOSES THE STREAM STANDARDS, WHICH REPRESENT ONLY A GENERAL OBJECTIVE, TO EFFLUENT STANDARDS, WHICH REPRESENT A SPECIFIC RESTRAINT ON THE INDIVIDUAL POLLUTER. FOLLOWING THIS, ABATEMENT SCHEDULES ARE APPROVED, BY WHICH THE TIMING FOR MEETING THE TARGET IS AGREED UPON. A NUMBER OF APPEALS ARE STILL PENDING, BUT 74% OF THE DISCHARGERS HAVE ALREADY ACCEPTED THE EFFLUENT STANDARDS. PROGRESS IS ALSO BEING MADE TOWARDS ORGANIZING CENTRALIZED (OR 'REGIONAL') WASTE COLLECTION, CONVEYANCE AND TREATMENT SYSTEMS, WHICH ARE EXPECTED TO PROVIDE ADVANTAGES OF ECONOMY, EFFICIENCY AND EASIER POLLUTION CONTROL. THE OPERATIONS OF THE DRBC ARE OF GREAT SIGNIFICANCE NATIONALLY, SINCE SIMILAR ACTIONS WILL HAVE TO BE TAKEN IN MANY DEVELOPED REGIONS, BUT INSTITUTIONS TO ESTABLISH SUCH PROGRAMS IN LARGE RIVER BASINS ARE GENERALLY LACKING. (W70-02694).

00127. STABILIZATION OF AN ACTIVATED SLUDGE PLANT.

WRIGHT, C.D.
WATER WASTES ENGR, 6(6), 34-36, JUNE 1969.

AN ACTIVATED SLUDGE PLANT (3 MDG) IN PLEASANT HILLS, PA., OPERATED SATISFACTORILY FOR SEVERAL YEARS THEN BECAME UNSTABLE OR UPSET. IT WAS SPECULATED THAT SHOCK LOADS CAUSED BY SHOPPING CENTERS, MOTELS, AND HOME GARAGE GRINDERS MIGHT BE RESPONSIBLE. THE PLANT WAS CONVERTED TO THE KRAUS PROCESS WITH SEPARATE AERATION OF RETURN ACTIVATED SLUDGE COMBINED WITH WASTE DIGESTER SUPERNATANT AND DIGESTED SLUDGE SOLIDS. THE DIGESTED SLUDGE SOLIDS ARE CONVERTED TO AN EXTREMELY LOW INDEX ACTIVATED SLUDGE AND THE AMMONIA NITROGEN RETURNED IN THE DIGESTER LIQUOR IS PARTIALLY CONVERTED TO NITRATE. THIS MATERIAL IS INTRODUCED TO THE AERATION TANKS. THE PROCESS ACHIEVES COMPLETE STABILIZATION UNDER SHOCK LOADS. THE PLANT WAS MODIFIED EARLY IN 1968 AND HAS OPERATED SATISFACTORILY SINCE THAT TIME. THE COST OF CONVERTING THE PLANT WAS ABOUT $15,000 TOTAL. (W70-02593).

00128. TIME CAPACITY EXPANSION OF WASTE TREATMENT SYSTEMS.

RACHFORD, T.M.; SCARATO, R.F.; TCHOBANOGLOUS, G.
J SANIT ENG DIV, ASCE, 95(SA6), 1063-1077, 1969.

A MINIMUM-COST METHOD WAS DEVELOPED FOR QUANTIFYING THE OPPOSING COST FACTORS OF ECONOMIES-OF-SCALE AND THE TIME COST OF MONEY AS THEY JOINTLY AFFECT OPTIMAL CAPITAL INVESTMENT DECISIONS FOR THE EXPANSION OF WASTEWATER TREATMENT SYSTEMS. FOR A LINEAR DEMAND GROWTH RATE, OPTIMAL FACILITY EXPANSION, WITH REGARD TO BOTH TIMING AND CAPACITY REQUIRMENTS, WAS DETERMINED USING A MATHEMATICAL MODEL. THE ECONOMIC IMPLICATIONS OF DIFFERENT EXPANSION POLICIES WERE GRAPHED FOR VARIOUS INTEREST RATES AND SCALE COST EFFECTS, USING COST DATA MATHEMATICALLY FORMULATED AS A FUNCTION OF SYSTEM CAPACITY. THE MODEL WAS USED TO DEMONSTRATE THAT THE OPTIMAL TIMING OF FACILITY EXPANSION WAS A FUNCTION OF THE TIME AND COST OF MONEY AND THE ECONOMY-OF-SCALE CHARACTERISTICS OF THAT FACILITY AND WAS INDEPENDENT OF INDIVIDUALLY EXPANDING SEPARABLE COMPONENTS OF WASTEWATER TREATMENT SYSTEM WERE QUANTIFIED BY THE MODEL. (W70-03167).

00129. EVALUATION OF ALTERNATIVE SOLUTIONS FOR ACHIEVEMENT OF RIVER STANDARDS.

QUIRK, T.P.; EDER, L.J.
PROC, SIXTEENTH SOUTHERN WATER RESOURCES POLLUT CONTR CONF, DUKE UNIV, P 33-54, APR 1967.

A RIVER OF APPROXIMATELY 170 MILES IN LENGTH, WITH A DRAINAGE AREA OF 3,500 SQUARE MILES WAS STUDIED. THE OBJECTIVES OF THE STUDY INCLUDED MATHEMATICAL SIMULATION MODEL OF THE RIVER TO PREDICT THE

BIOCHEMICAL OXYGEN DEMAND (BOD) AND DISSOLVED OXYGEN (DO) PROFILES UNDER ANY CONDITION OF FLOW TEMPERATURE OR WASTE DISHARGES, (C) APPLICATION OF THE SIMULATION MODEL TO INVESTIGATE IN DETAIL AND BOD ASSIMILATION CAPACTIY UNDER CRITICAL WEATHER AND FLOW CONDITIONS AND THE EFFECTS OF SLUDGE DEPOSITS, HYDROTURBINE VENTING AND FLOW AUGMENTATION AND, (D) DEVELOPMENT OF THE COMPARATIVE ECONOMICS OF ALTERNATIVE SOLUTIONS FOR ACHIEVEMENT OF PROPOSED WATER QUALITY STANDARDS. THE RIVER MODEL WAS USED FOR THE DEVELOPMENT OF THE EFFECTS AS WELL AS COMBINATION OF SOLUTIONS WHICH APPEARED PRACTICAL AND ECONOMICALLY ATTRACTIVE. (W70-03165).

00130. ECONOMICS EVALUATION: ALTERNATIVES FOR INDUSTRIAL TREATMENT.

CAMIN, K.Q.
WATER AND SEWAGE WORKS (INDUSTRIAL WASTES SUPPLEMENT), 116(7), P IW/8-IW/13, JULY 1969.

THE ALTERNATIVES FOR INDUSTRIAL DISPOSITION OF WASTES ARE THE FOLLOWING: (1) COMPLETE TREATMENT BY MUNICIPALITY, (2) COMPLETE TREATMENT BY THE INDUSTRY, (3) PARTIAL TREATMENT BY INDUSTRY FOLLOWED BY MUNICIPAL TREATMENT, OR (4) ALTERATION OF PROCESS TO PRODUCE LESS WASTE AND/OR LOWER STRENGTH. A HYPOTHETICAL MEAT PACKING PLANT IS USED AS AN EXAMPLE TO ILLUSTRATE THE COSTS OF THE VARIOUS ALTERNATIVES IN PRIMARY COSTS (REPAYMENT OF PRINCIPAL, INTEREST, AND OPERATION AND MAINTENANCE) AND SECONDARY COSTS (PENALTIES, SALE OF PRODUCTS, AND PUBLIC RELATIONS). THE ANNUAL COSTS ARE COMPUTED FOR TRICKLING FILTER, ANAEROBIC CONTACT, AND ANAEROBIC-AEROBIC LAGOONS. THE PRESENT VALUES OF THE ALTERNATIVES SHOW THE PROPER SELECTION OF TREATMENT FOR DIFFERENT INTEREST RATES. (W70-03060).

00131. DIATOMITE FILTRATION IN A BOARD MILL.

HUTTO, F.B. JR.,
WATER WASTES ENG (INDUSTRIAL), 6(3), P B.5-B.9, 1969.

A CLOSEUP RECYCLE OF WASTEWATER IS DESCRIBED FOR A FESCO BOARD (PERLITE, WOOD PULP, ASPHALT, AND ADMIX) PLANT IN FRANCE. A DIATOMACEOUS EARTH FILTER (CELITE 545) WITH A CAPACITY OF 300 GPM WAS INSTALLED AFTER PILOT PLANT TESTS OF VARIOUS FILTER AIDS, INCLUDING PERLITE. ROTARY KNIVES REMOVE THE CAKE FROM THE DRUM. ABOUT 1 TON PER WEEK OF THE CELITE 545 MUST BE REPLACED. RIVER WATER FOR MAKE UP IS BROUGHT INTO THE SYSTEM THROUGH THE ROTARY PRECOAT FILTER. E
OCCURS AT APPROXIMATELY 6000 GPH, WHEREAS THE VOLUME OF THE LOOP IS ONLY 12000 GAL. THE SUCCESS OF THE CLOSED CYCLE LAY IN SUCCESSFUL REMOVAL OF SOLIDS, STABILIZATION OF SOLUBLES BUILDUP, AND RETURN WATER REUSED. (W70-03058)

00132. TERTIARY TREATMENT AT METRO CHICAGO BY MEANS OF RAPID SAND FILTRATION AND MICROSTRAINERS.

LYNAM, B.T., ETTELT, G., MCALOON, T.
J WATER POLLUT CONTR FEDERATION, 41(2), PART 1, P 247-279, FEB 1969.

RESULTS ARE REPORTED ON 5 MONTHS OF INVESTIGATION INTO TERTIARY TREATMENT OF HANFORD PARK (CHICAGO) EFFLUENT. A 2 MGD PLANT WITH RAPID SAND FILTERS (TRAVELING BACKWASH) AND MICROSTRAINER WAS OPERATED UNDER VARYING CONDITIONS. THE SAND FILTER WAS FOUND TO BE MORE ECONOMICAL THAN THE MICROSTAINER FOR EFFECT ACHIEVED, $0.024/1000 GAL VS $0.029/1000 GAL. EITHER METHOD WITH PRECHLORINATION CAN MEET 5 MG/L SUSPENDED SOLIDS AND 4 MG/L BOD CRITERIA OF ILLINOIS SANITARY WATER BOARD. COAGULATION WITH ALUM DID NOT IMPROVE THE RESULTS ACHIEVED. (W70-03056)

00133. TREATMENT OF MIXED INDUSTRIAL WASTES AT BAYPORT'S INDUSTRIAL COMPLEX.

MERIWHETHER, G.B.
J WATER POLLUT CONTR FEDERATION, 41(3), PART 1, P 440-444, 1969.

A CENTRAL WASTE TREATMENT FACILITY IS DESCRIBED. IT IS SERVING 6 INDUSTRIES PRESENTLY WITH 6 MORE INDUSTRIES UNDER CONSTRUCTION. THE CAPACITY IS ABOUT 1 MGD NOW AND CAN BE EXPANDED TO 40 MGD. THE WASTES ARE SORTED INTO 3 CLASSES: A 'CLEAN' STREAM, A 'BIOLOGICAL' STREAM, AND A NON-ACCEPTABLE STREAM. THE FIRST TWO CATEGORIES CAN BE TREATED BIOLOGICALLY WHILE THE THIRD REQUIRES INCINERATION OR DEEP-WELL INJECTION. THE PLANT CHARGES $0.34 TO $0.44 PER 1000 GAL WITH BOD UP TO 250 MG/L AND $0.22 PER LB OF BOD FOR WASTES WITH BOD GREATER THAN 250 MG/L. (W70-03053)

00134. POLLUTION ABATEMENT OF A DISTILLERY WASTE.

BURKHEAD, C.E.; LESSIG, C.A.; RICHARDSON, T. R.
WATER WASTES ENG, 6(5), P C.20-C-22, MAY 1969.

OPERATING DATA FOR A PILOT PLANT WASTE TREATING OPERATION IS DESCRIBED. A 5000-GAL HOLDING TANK (FOR COOLING WASTES) AND A 10,000-GAL EXTENDED AERATION ACTIVATED SLUDGE TANK (INCLUDING A 1670-GAL SETTLING UNIT) WERE USED TO TREAT LOADINGS OF 7,250 TO 10,500 GAL PER DAY OF WASTES. BOD REMOVALS RANGED FROM 77 TO 97% (AVG OF 91.5%) AT LOADINGS OF 3 TO 27 LB/DAY-1000 CUFT (AVG OF 18 LB). THE VOLUME OF THE HOLDING TANK IS INCLUDED IN THE LOADING CALCULATIONS. THE EFFLUENT QUALITY MUST BE OF THE ORDER OF 20 TO 30 MG/L BOD. AERATED LAGOONS GIVE AN ECONOMICAL ADAPTATION OF THE ACTIVATED SLUDGE PROCESS. IN ADDITION TO BOD REOVAL, THE LARGE SURFACE AREA ENHANCES HEAT REMOVAL FROM THE HOT WASTES. THE AERATED LAGOON DESIGN WAS FOR A POND 3 FEET DEEP WITH 5 DAYS RETENTION. THE POND MAY BE OPERATED AT A DEPTH OF 5 FEET IF NECESSARY TO GET THE DESIRED EFFLUENT QUALITY. THE COST OF THE POND CONSTRUCTION IS ESTIMATED AT $71,000. (W70-03043)

00135. AERATED STABILIZATION BASIN TREATMENT OF WHITE WATER.

QUIRK, T.P.
WATER WASTES ENG, 6(7), P D.1-D.5, 1969.

A STUDY OF A BOXBOARD MANUFACTURING WASTE AND ITS BIOLOGICAL TREATMENT IS DESCRIBED. THE PERFORMANCE OF AN EXISTING CLARIFIER WHICH REMOVED 65 TO 95% OF THE SUSPENDED SOLIDS (600 TO 1800 MG/L) AND REDUCED THE BOD BY 35 TO 40% WAS STUDIED. A PILOT SCALE AERATED STABILIZATION BASIN WAS USED TO STUDY THE EFFICACY OF THIS TYPE OF TREATMENT. THE ADDITION OF NITROGEN AND PHOSPHORUS PERMIT A 75% BOD REMOVAL WITH A SHORT-TERM BASIN AND A CLARIFIER OR A LONG-TERM BASIN WITHOUT A CLARIFIER. THE MINIMUM COST ALTERNATIVES WAS ESTIMATED

AT ABOUT 4.5 CENTS PER POUND OF BOD REMOVED. (W70-03041).

00136. ECONOMICS OF SPLIT-TREATMENT WATER SOFTENING.

SHUEY, B.S.
AMERICAN WATER WORKS ASSOCIATION JOURNAL, 58(1), P 107-112, 1966.

SPLIT-TREATMENT LIME-SODA WATER SOFTENING CAN BE UNDER CERTAIN RESTRICTED CONDITIONS. THE COSTS OF THIS PROCESS, AS OPPOSED TO SINGLE-STAGE SOFTENING, ARE COMPARED AND THE FORMER ARE FOUND TO BE MORE ECONOMICAL. THE THREE REASONS FOR THIS ARE DISCUSSED AND IT WAS FOUND THAT WHEN A FINISHED WATER WITH THE MINIMUM TOTAL ALKALINITY IS PRODUCED AND AN AVERAGE OF 54 MGD IS TREATED THE ANNUAL SAVINGS AMOUNTED TO MORE THAN $80,000. MODIFICATION IN THE METHOD, RESULTING IN A FINISHED WATER WHICH HAS AGGRESSIVE CHARACTERISTICS, CAN STILL BE ACCOMPLISHED WITH AN ANNUAL SAVING OF $55,000 AT THE SAME TREATMENT RATE. (W70-02989).

00137. WATER QUALITY MANAGEMENT AND THE TIME PROFILE OF BENEFITS AND COSTS.

PARKER, D.S.; CRUTCHFIELD, J.A.
WATER RESOURCES RESEARCH, 4(2), PP 233-246, 1968.

ECONOMISTS, IN EVALUATING THE LONG-TERM BENEFITS IN PUBLIC WORKS PROJECTS, HAVE TRADITIONALLY HELD THAT LONG-TERM BENEFITS WILL CONTRIBUTE LITTLE TO THE TOTAL PRESENT WORTH OF THE BENEFITS ACCRUED OVER THE LIFE OF THE PROJECT. IT IS SHOWN, HOWEVER, THAT THE LONG-TERM SOCIAL COST RESULTING FROM THE PROJECTS THAT CAUSE WATER POLLUTION CANNOT BE NEGLECTED OR ASSUMED AWAY IN THE MANY PRACTICAL CASES WHERE 'AMENITY' DEMAND OF GOOD WATER QUALITY IN A PROJECT'S AREA OF INFLUENCE ARE SIGNIFICANT. (W69-01071).

00138. ALTERNATIVE METHODS OF IMPROVING STREAM QUALITY: AN ECONOMIC AND POLICY ANALYSIS.

BRAMHALL, D.F.; MILLS, E.S.
WATER RESOURCES RESEARCH, 2(3), 355-363, THIRD QUARTER 1966.

NEITHER MARKETS NOR OTHER INSTITUTIONAL MECHANISMS EXIST WHICH REGISTER THE BENEFITS AND COSTS OF ALTERNATIVE STREAM QUALITIES OR OF ALTERNATIVE METHODS OF ACHIEVING A GIVEN STREAM QUALITY. IT IS THEREFORE NECESSARY TO STUDY SUCH BENEFITS AND COSTS AND TO DESIGN SPECIAL PUBLIC POLICIES TO ACHIEVE DESIRABLE STREAM QUALITIES IN AN ECONOMICAL WAY. THE TWO PROMINENT METHODS OF IMPROVING STREAM QUALITY ARE WASTE TREATMENT AND LOW FLOW AUGMENTATION. ESTIMATES ARE PRESENTED OF THE COST OF ACHIEVING GIVEN STREAM QUALITIES BY VARIOUS COMBINATIONS OF WASTE TREATMENT AND LOW FLOW AUGMENTATION. DATA IS TAKEN FROM THE AUTHOR'S STUDY OF FUTURE WATER SUPPLY AND DEMAND IN MARYLAND, BUT THE CONCLUSIONS ARE THOUGHT TO BE APPLICABLE THROUGH THE HUMID EASTERN PART OF THE UNITED STATES. THE MAIN CONCLUSION IS THAT LOW FLOW AUGMENTATION IS A LESS ECONOMICAL METHOD OF IMPROVING STREAM QUALITY THAN ABOUT 90% WASTE REMOVAL BY SECONDARY TREATMENT, OR ITS EQUIVALENT IN INDUSTRIAL PROCESS CHANGES AT THE POINT OF WASTE GENERATION. ALTERNATIVE PUBLIC POLICIES FOR ACHIEIVING IMPROVED STREAM QUALITIES BY ECONOMIC METHODS ARE EVALUATED. A COMBINATION OF EFFLUENT FEES AND ENFORCEMENT IS JUDGED DESIRABLE. (W69-01068).

00139. SUMMARY REPORT ADVANCED WASTE TREATMENT PROGRAM, JULY 1964-JULY 1967.

TAFT, R.A.
FED WATER POLLUT CONTR, RES SER PUBLICATION WP-20-AWTR-19, 96 P, 1968.

RESULTS OF WASTE-TREATMENT STUDIES FROM 1964-67 ARE SUMMARIZED. THE TREATMENT METHODS STUDIED INCLUDE SOLIDS REMOVAL, ORGANIC REMOVAL, INORGANIC REMOVAL, NUTRIENT REMOVAL, AND ULTIMATE DISPOSAL. LIME CLARIFICATION, WHICH REMOVES SUSPENDED SOLIDS AND DISSOLVED PHOSPHATES, IS ALSO USED IN POTABLE WATER SUPPLY SYSTEMS AND IS ECONOMICALLY FAVORABLE. ALUM CLARIFICATION SHOULD BE SUCCESSFUL AT A COST OF 8 CENTS PER 1,000 GALS. ACTIVATED, GRANULAR, AND POWDERED CARBON TREATMENT SHOULD COST 8-12 CENTS PER 1,000 GALS IF THE CARBON CAN BE REACTIVATED. ELECTRODIALYSIS SHOULD COST 16 CENTS PER 1,000 GAL IF FOULING OF MEMBRANES IS ELIMINATED BY PRETREATMENT OF EFFLUENT. ION EXCHANGE AND REVERSE OSMOSIS SHOULD BE COMPETITIVE WITH ELECTRODIALYSIS. NITROGEN REMOVAL IS A DIFFICULT PROBLEM, FOR WHICH AIR-STRIPPING OF AMMONIA APPEARS FEASIBLE AND SHOULD NOT COST OVER 2 CENTS PER 1,000 GALS. HIGHLY NITRIFIED ACTIVATED CARBON OR LIQUID EFFLUENT SHOWS PROMISE FOR ULTIMATE NITRATE REMOVAL. (W69-01169).

00140. OPTIMAL TAXING OF WATER POLLUTION.

UPTON, C.
WATER RESOURCES RESEARCH, 4(5), 865-875, 1968.

THIS PAPER ATTEMPTS TO SHOW THAT, WITHIN THE CONTEXT OF THE MODEL PRESENTED, OPTIMAL TAXES ON WATER POLLUTION DO EXIST. THE CONDITION FOR THESE TAXES IS TO RAISE REVENUE SUFFICIENT TO PAY FOR THE COST OF LOW FLOW AUGMENTATION. THE SOCIAL COST OF CLEANER WATER IS ALSO CALCULATED. THE 'WASTE' LOAD DISCHARGE METHOD OF TAXATION IS THEN SHOWN TO BE PREFERABLE TO THE 'INCREASED PERMISSIBLE WASTE LOAD METHOD' WHEN TAXES DO NOT COVER AUGMENTATION COSTS. THE DIFFERENCE BETWEEN AUGMENTATION COSTS AND TAXES, THE SUBSIDY IS DEFINED AS A FUNCTION OF MARGINAL AND AVERAGE COSTS OF STREAMFLOW. IF THERE ARE ECONOMIES OF SCALE (MC, AC), THEN THE SUBSIDY IS NEGATIVE; IF THERE ARE DISECONOMIES OF SCALE, IT IS POSITIVE. TAXES WILL COVER TREATMENT COSTS IF AND ONLY IF THE SUBSIDY IS GREATER THAN OR EQUAL TO ZERO. (W69-01084).

00141. PRELIMINARY DESIGN AND SIMULATION OF CONVENTIONAL WASTEWATER RENOVATION SYSTEMS USING THE DIGITAL COMPUTER.

SMITH, R.
WATER POLLUT CONTR RES SER PUBLICATION NO WP-20-9, 64 P, MARCH 1968.

A DIGITAL COMPUTER METHOD AND A FORTRAN IV PROGRAM LISTING, USED TO BRING TOGETHER PREVIOUSLY SEPARATE CALCULATIONS FOR COST AND PERFORMANCE OF THE INDIVIDUAL PROCESSESS OF WASTE WATER TREATMENT SYSTEMS INTO ONE COMPUTATION FOR AN ENTIRE SYSTEM, ARE PRESENTED WITH A THOROUGH

REVIEW AND DISCUSSION OF THE SUBJECT. THIS PROGRAM MAKES IT POSSIBLE WITH A FAIR DEGREE OF RELIABILITY TO COMPUTE THE CAPITAL COST, AMORITIZATION OR DEBT SERVICE COST, AND OPERATING AND MAINTENANCE COST OF THE ENTIRE PLANT OR OF INDIVIDUAL PROCESSES OR GROUPS OF PROCESSES, AS A FUNCTION OF INDEPENDENT DESIGN CAPACITY, INFLUENT STREAM, FRACTION OF SUSPSENDED SOLIDS REMOVED IN THE PRIMARY SETTLER, MIXED LIQUOR SUSPENDED SOLIDS HELD IN THE AERATOR, DEMAND BOD OF PLANT EFFLUENT, AND DETENTION TIME FOR THE DIGESTER. RESULTS OF COMPUTATIONS ARE SHOWN IN TABLES AND GRAPHS. THE PROGRAM WAS SLANTED TOWARD PRELIMINARY DESIGN RATHER THAN OPERATION SIMULATION, BUT THE DIFFERENCE IS NOT FUNDAMENTAL BECAUSE ONLY STEADY STATE PERFORMANCE IS CONSIDERED. (W69-00926).

00142. ALTERNATIVE ECONOMIC RESPONSES TO THE ACID MINE DRAINAGE PROBLEMS IN APPALACHIA.

TYBOUT, R.A.
WATER RESOURCES CENTER, FEB 1968. 42 P.

THE STUDY CONSISTS OF A COST-BENEFIT ANALYSIS OF THE POLLUTION ABATEMENT PROBLEM FROM ACID MINE DRAINAGE. EMPIRICAL INFORMATION IS BASED PRIMARILY ON EXPERIENCES IN PENNSYLVANIA, THE ONLY PUBLIC PROGRAM FOR ABATEMENT IN EFFECT AT THE PRESENT TIME. COSTS ARE FOUND IN 3 PARTS: (1) COST OF TREATMENT; (2) COST OF SEALINRE CONSTRUCTED COUNTY-BY-COUNTY TO ISOLATE EFFECTS OF TREATMENT COSTS ON EMPLOYMG; AND (3) SECONDARY COSTS. FIRST, EMPLOYMENT, WAGE, PRICE, AND PRODUCTION SERIES WEENT. SECOND, FOR GENERALIZING COSTS TO THE STATES, PREDICTING MINE DRAINAGE WAS ANALYZED ON THE BASIS OF (1) VOLUME OF DRAINAGE PER TON OF COAL MINED, BY COUNTY, WITH SUBCASES FOR DEEP AND STRIP MINING WITH CORRECTIONS FOR SEAM THICKNESS AND HYDROLOGIC CONDITIONS, (2) QUALITY OF DRAINAGE AS AFFECTED BY SURROUNDING GEOLOGICAL STRATA. BENEFITS ARE FOUND FOR (1) MUNICIPAL WATER TREATMENT, (2) INDUSTRIAL WATER USAGE, AND (3) RECREATION. AESTHETIC IMPROVEMENTS ARE ALSO BENEFITS, BUT A METHOD OF MEASURING IS NOT CURRENTLY AVAILABLE. THEREFORE, THE LEVEL OF AESTHETIC BENEFITS REQUIRED TO OFFSET COSTS WAS DETERMINED BY DIFFERENCE. BENEFITS OF COMMUNITY IMPACT OF TOURIST EXPENDITURES ARE INCLUDED. CONCEPTUAL LIMITATIONS TO THE USE OF SECONDARY COSTS AND BENEFITS ARE NOTED. (W69-00972)

00143. OXYGEN MANAGEMENT AND ARTIFICIAL REAERATION IN THE AREA OF BALDENEY LAKE AND THE LOWER RUHR RIVER (IN GERMAN).

IMHOFF, K.R.
ENGLISH SUMMARY. DAS GAS- UND WASSERFACH, 109 JAHRG (1968), HEFT 34, SEITE 936-941 (WASSER-ABWASSER).

THE RUHR RIVER IN GERMANY HAS PRESENTED A MAJOR POLLUTION CONTROL PROBLEM FOR A LONG TIME. ALTHOUGH ONLY A SMALL RIVER, THE EQUIVALENT OF SEWAGE FROM OVER 2 MILLION POPULATION COMES THROUGH THE CENTRAL AREA NEAR THE CITY OF ESSEN. IN ADDITION TO VERY STRICT CONTROL OF EFFLUENTS BY WASTE TREATMENT PLANTS, THE POLLUTION CONTROL AGENCY, THE RUHRVERBAND, HAS APPLIED INSTREAM AERATION AS A SUPPLEMENTAL MEANS. THREE AERATION METHODS HAVE BEEN USED: BY INTRODUCING AIR INTO HYDRAULIC TURBINES, BY DIFFUSERS (BUBBLING FROM SUBMERGED ORIFICES), AND BY MECHANICAL AERATORS. TECHNICAL ANALYSIS ALLOWS AN ECONOMIC COMPARISON AS FOLLOWS. IN ORDER TO REMOVE ORGANIC POLLUTION OF ONE POPULATION EQUIVALENT, AT TIMES OF LOW FLOW, THE COST WOULD AMOUNT TO 0.81 DM FOR A MECHANICAL AERATOR, AND 0.22 DM WITH THE TURBINE AERATOR, AS COMPARED TO 4.0 DM FOR EXPANSION OF THE TREATMENT PLANT TO ACHIEVE THE SAME RESULT. OTHER FIGURES SHOW THE DIFFUSER AS MUCH LESS ECONOMIC THAN THE MECHANICAL AERATOR, THOUGH PART OF THE EXTRA COST IS DUE TO CERTAIN SPECIAL CIRCUMSTANCES. THIS RESULT IS AN ACCORD RECENT AMERICAN FINDINGS THAT INSTREAM AERATION IS AN ECONOMICAL MEANS IN SEVERE POLLUTION SITUATIONS. (W70-01224)

00144. POLLUTION--CAUSES, COSTS, CONTROL.

CHEM ENG NEWS, P 33-68, JUNE, 1969.

THE PRINCIPAL CAUSES OF AIR AND WATER POLLUTION, THE COSTS OF POLLUTION ABATEMENT, AND THE LEGISLATIVE AND ENFORCEMENT MEASURES TAKEN BY VARIOUS LEVELS OF GOVERNMENT TO CONTROL THE ENVIRONMENT ARE REVIEWED. IMPORTANT TECHNOLOGICAL DEVELOPMENTS AND ACTIONS TAKEN BY INDUSTRY TO HALT POLLUTION ARE INCLUDED. THE INCREASING MAGNITUDE OF THE PROBLEM IS CAUSED BY 2 MAIN FACTORS: URBANIZATION AND TECHNICAL ADVANCE. TODAY'S WATER POLLUTION PROBLEMS ARE MUCH DIFFERENT THAN THE TYPHOID FEVER PROBLEMS A FEW DECADES AGO; THE PROBLEMS TODAY ARE CONCERNED WITH SYNTHETIC CHEMICAL CONTAMINATES. THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION ESTIMATES THAT AT LEAST $26 BILLION WILL BE NEEDED TO BRING LAKES AND STREAMS UP TO WATER QUALITY STANDARDS BY 1973. FEDERAL, STATE, AND LOCAL AIR AND WATER POLLUTION PROGRAMS ARE DISCUSSED. FEDERAL LEGISLATION ON AIR AND WATER POLLUTION IS REVIEWED. A RESUME IS INCLUDED OF THE MANUFACTURING CHEMISTS ASSOCIATION REPORT ON THE ACTIVITIES OF THE CHEMICAL MANUFACTURING INDUSTRY TO CONTROL POLLUTION. A DIRECTORY IS GIVEN OF COMPANIES, EQUIPMENT, PRODUCTS, SERVICES, OR SUPPLIES FOR USE IN POLLUTION CONTROL. (W70-01100)

00145. SPECIAL REQUIREMENTS FOR A FULL SCALE FIELD DEMONSTRATION OF THE ASCE COMBINED SEWER SEPARATION PROJECT SCHEME.

WALLER, D.H.
ASCE COMBINED SEWER SEPARATION PROJECT, TECHNICAL MEMORANDUM NO 13, JUNE 3, 1968, 84 P.

MATTERS THAT SHOULD BE CONSIDERED IN PLANNING A FIELD DEMONSTRATION OF THE ASCE PROJECT PRESSURE SEWER SCHEME ARE SUMMARIZED. THESE INCLUDE: IMPORTANCE OF CONNECTING AS MANY BUILDINGS AS POSSIBLE IN THE DEMONSTRATION PROJECT AREA; NEED FOR PROTECTION FROM OVERFLOWS OF BUILDING STORAGE-GRINDER-PUMP UNITS; RELATIONSHIP BETWEEN OCCURRENCE OF DETECTION AND CONTROL; EFFECTIVENESS OF ALARMS ON STORAGE-GRINDER-PUMP UNITS; LEGAL AGREEMENTS WITH PROPERTY OWNERS; IMPORTANCE OF COMPLETE RECORDS OF PROJECT COSTS; EFFECTIVENESS OF THE PROJECT AS A POLLUTION CONTROL MEASURE; POSSIBLE BENEFITS OF ELIMINATION OF INFILTRATION FROM INTERCEPTORS AND TREATMENT PLANTS; DETECTION AND CLEARING OF OBSTRUCTION; USE OF POLYMER ADDITIVES TO REDUCE FLUID FRICTION; BEHAVIOR OF UNGROUND SEWAGE INCLUDING ANAEROBIC DECOMPOSITION, SELF-CLEANSING CHARACTERISTIC OF FLOW, RATE AND EXTENT OF DETERIORATION OF

FRICTION FACTORS, SEWAGE FLOW VARIATIONS AND THEIR RELATIONSHIP TO WATER DEMANDS; HANDLING OF INTERRUPTIONS OF SERVICE; AND FIELD TESTS ON INSTALLATIONS IN WALK-THROUGH COMBINED SEWERS. THE APPENDIX IS AN ASSESSMENT OF THE PHYSICAL PROBLEMS TO BE OVERCOME IN SEPARATION OF PLUMBING ON PRIVATE PROPERTY, WITH ESTIMATES OF COST, BASED ON INFORMATION FROM OFFICIALS IN SEVEN LARGE CITIES HAVING COMBINED SEWERS, AND FROM A CONSULTING ENGINEER AND A RECENT AMERICAN PUBLIC WORKS ASSOCIATION SURVEY. (PB-186 009) (W70-01066).

00146. AN EXAMINATION OF THE BENEFITS AND DISADVANTAGES WITH RESPECT TO THE DISPOSAL OF SOLID WASTES.

WALLER, D.H.

ASCE COMBINED SEWER SEPARATION PROJECT, TECHNICAL MEMORANDUM NO 10, FEB. 1, 1968. 54 P.

IMPORTANT CONSIDERATIONS IN AN EVALUATION OF THE FEASIBILITY AND BENEFITS OF ADAPTING ANY SEWERAGE SYSTEM TO SOLID WASTE DISPOSAL ARE: THE EXTRA SOLIDS LOAD THAT COMMUNITY REFUSE COULD ADD TO A SEWAGE DISPOSAL SYSTEM, VELOCITIES REQUIRED TO MOVE SOLID WASTES, SEPARATION EFFECT OF FLOW VARIATIONS ON SEWER VELOCITIES, SOLID WASTES SEPARATION PRACTICES AND ATTITUDES TOWARD SEPARATION OF HOUSEHOLD REFUSE, THE NEED FOR GRINDING DEVICE, THE EFFECTS OF SOLID WASTES ON SEWAGE TREATMENT PROCESSES, AND COSTS AND BENEFITS INVOLVED IN EVALUATION OF ALTERNATIVE SYSTEMS FOR DISPOSAL OF SEWAGE AND SOLID WASTES. CONSIDERATION PECULIAR TO THE ASCE PROJECT SCHEME ARE: THE POSSIBILITY OF ADAPTING BUILDING SEWAGE STORAGE-GRINDER-PUMP UNITS FOR HANDLING SOLID WASTES, THE NEED TO DISCHARGE SOLID WASTES INTO THE SYSTEM UNDER PRESSURE, REDUCED CLEARANCES IN THE SMALL PIPES OF A PRESSURE SYSTEM; AND THE POSSIBILITY OF GREATER SOLIDS DEPOSITION AT LOW FLOWS. APPENDICES INCLUDE INFORMATION ON COMPOSITION AND CHARACTERISTICS OF SOLID WASTES, PERTINENT SOLID WASTES RESEARCH AND DEVELOPMENT, AND RESULTS OF RESEARCH ON TRANSPORT AND TREATMENT OF SOLID WASTES IN SEWAGE DISPOSAL SYSTEMS. (PB-186 006) (W70-01063).

00147. PRESSURE TUBING FIELD INVESTIGATION.

TUCKER, L.S.

ASCE COMBINED SEWER SEPARATION PROJECT, TECHNICAL MEMORANDUM NO 5, AUG 15, 1967 29 P.

THREE METHODS OF INSTALLING PRESSURE TUBING FROM HOUSES OR SMALL BUILDINGS, AND OF CONNECTING THE TUBING WITH STREET PRESSURE CONDUITS, ARE DESCRIBED AND DISCUSSED. ONE WOULD BE THE INSTALLATION AND CONNECTION OF PRESSURE TUBING AND CONDUITS IN TRENCHES BY TRADITIONAL WATER DISTRIBUTION METHODS. FIELD TRIALS WERE CONDUCTED TO INDICATE THE FEASIBILITY OF INSERTING TUBING IN BUILDING SEWERS. TUBING WAS PUSHED THROUGH AN 86-FOOT LONG 4- 5-INCH DIAMETER BUILDING LATERAL, WHICH INCLUDED THREE 45 DEG BENDS, FROM A SPECIALLY DUG PIT AT THE UPSTREAM END INTO 4-FOOT DIAMETER COMBINED SEWER. THE FORWARD END OF THE TUBING WAS GUIDED BY A SPECIAL LEADER DEVICE. THREE FOURTHS-, 1-, AND 1 1/2-INCH POLYETHYLENE TUBING COULD BE PUSHED. POLYBUTHLENE AND COPPER TUBES COULD NOT BE PUSHED BECAUSE THEY BUCKLED OR CRIMPED. A KELLEMS GRIP AND SWIVEL ON THE END OF A ROPE WERE USED TO PULL TUBING FROM THE COMBINED SEWER TO THE UPSTREAM PIT. THREE FOURTHS-, 1-, AND 1 1/4-INCH POLYETHYLENE AND 3/4- AND 1-INCH POLYBUTHLENE COULD BE PULLED. THREE FOURTHS-INCH COPPER TUBING COULD NOT BE PULLED BECAUSE OF ITS STIFFNESS. THE THIRD METHOD, TESTED IN THE FIELD, COMBINED THE INSERTION OF TUBING WITH A STREET MAIN IN TRENCH. COST ESTIMATES WERE MADE FOR THE LATTER TWO METHODS. (PB-186 011) (W70-01058).

00148. SEPARATION OF COMBINED WASTEWATER AND STORM DRAINAGE SYSTEMS, SAN FRANCISCO STUDY AREA.

ASCE COMBINED SEWER SEPARATION PROJECT REPORT, SEPT 1968. 81 P.

THE REPORT IS ONE OF THREE BY CONSULTANTS TO STUDY THE DESIGN, ESTIMATE COSTS AND EVALUATE THE FEASIBILITY OF THE HYPOTHETICAL APPLICATION OF THE ASCE PROJECT SCHEME OF PRESSURE SEWERS FOR SEPARATION IN REPRESENTATIVE COMBINED SEWER AREAS FROM LAYOUTS BY THE PROJECT STAFF. THE SAN FRANCISCO STUDY CONSIDERED THE 323 ACRE PREDOMINATLY RESIDENTIAL, STEEPLY SLOPING LAGUNA STREET SEWER SERVICE DISTRICT, REBUILT SINCE THE 1906 FIRE. THE REPORT DESCRIBES METHODS OF BUILDING PLUMBING SEPARATION AND INDICATES TWO ALTERNATIVES ARRANGEMENTS OF PRESSURE SEWERS, WITH PLANS AND PROFILES. ESTIMATES OF CONSTRUCTION COSTS OF EACH ($13,000,000 AND $13,350,000) ARE COMPARED WITH THAT OF A CONVENTIONAL GRAVITY SYSTEM OF SEPARATION DESIGNED EARLIER BY THE CITY ($8,800,000). PLUMBING SEPARATION, INCLUDED IN THE ABOVE, IS ESTIMATED TO COST ABOUT $5,400,000 FOR THE GRAVITY METHOD AND ABOUT $4,400,000 FOR THE PRESSURE METHOD NOT INCLUDING STORAGE-GRINDER-PUMP UNITS. (PB-186 001) (W70-01083).

00149. COMBINED SEWER SEPARATION PROJECT, REPORT ON MILWAUKEE STUDY AREA.

ASCE COMBINED SEWER SEPARATION PROJECT REPORT, DEC 1968. 84 P.

THE REPORT IS ONE OF THREE BY CONSULTANTS TO STUDY THE DESIGN, ESTIMATE COSTS AND EVALUATE FEASIBILITY OF THE HYPOTHETICAL APPLICATION OF THE ASCE PROJECT SCHEME OF PRESSURE SEWERS FOR SEPARATION IN REPRESENTATIVE COMBINED SEWER AREAS FROM LAYOUTS BY THE PROJECT STAFF. THE MILWAUKEE STUDY CONSIDERED THE 157-ACRE MAINLY DENSE RESIDENTIAL, MODERATELY SLOPING PROSPECT AVENUE STUDY AREA ESSENTIALLY BUILT PRIOR TO 1930 WITH MANY BUILDINGS DATING FROM BEFORE 1900. THE REPORT DESCRIBES METHODS OF BUILDING PLUMBING SEPARATION AND INDICATES TWO ALTERNATIVE ARRANGEMENTS OF PRESSURE SEWERS WITH PLANS AND A PROFILE. ESTIMATES WITH THAT OF A CONVENTIONAL GRAVITY SYSTEM OF SEPARATION DESIGNED BY THE CONSULTANT ($2,195,000). PLUMBING SEPARATION, INCLUDED IN THE ABOVE, IS ESTIMATED TO COST $912,000 FOR THE GRAVITY ALTERNATIVE AND $971,000 FOR THE PRESSURE ALTERNATIVES, NOT INCLUDING STORAGE-GRINDER-PUMP UNITS. (PB-186 003) (W70-01052).

REFERENCE LIST

00150. REPORT ON PRESSURE SEWERAGE SYSTEM, SUMMER STREET SEPARATION STUDY AREA, BOSTON, MASSACHUSETTS.

ASCE COMBINED SEWER SEPARATION PROJECT. REPORT SEPT 1968, 82 P.

THE REPORT IS ONE OF THREE CONSULTANTS TO STUDY THE DESIGN, ESTIMATE COSTS AND EVALUATE THE FEASIBILITY OF THE HYPOTHETICAL APPLICATION OF THE ASCE PROJECT SCHEME OF PRESSURE SEWERS FOR SEPARATION IN REPRESENTATIVE COMBINED SEWER AREAS FROM LAYOUTS BY THE PROJECT STAFF. THE BOSTON STUDY CONSIDERED THE 53-ACRE GENTLYSLOPING, HETEROGENEOUS COMMERICAL SUMMER STREET SEPARATION STUDY AREA, INCLUDING MANY BUILDINGS BUILT IN THE LATE 1800'S. THE REPORT DESCRIBES THE SEPARATION OF BUILDING PLUMBING IN DETAIL IN A TYPICAL THREE-QUARTER CENTURY OLD FIVE STORY AND BASEMENT COMMERICAL BUILDING 65-FT. BY 145-FT IN PLAN, AND ESTIMATES THE COST OF PLUMBING SEPARATION. FOUR ALTERNATIVE PRESSURE SEWER COLLECTION SYSTEMS ARE INDICATED WITH PLANS AND HYDRAULIC PROFILES. SOME SYSTEMS INCLUDED IN-LINE MAIN PUMPING STATION. THE LEAST EXPENSIVE COMPLETE PRESSURE SYSTEM, WHICH DID NOT INCLUDE A MAIN PUMPING STATION, IS ESTIMATED TO COST $6,400,000 COMPARED TO THE COST OF A GRAVITY SEPARATION SYSTEM DESIGNED BY THE CONSULTANTS, ESTIMATED TO COST $4,700,000. BOTH COSTS INCLUDE COSTS OF BUILDING PLUMBING SEPARATION, $4,000,000 FOR THE PRESSURE SYSTEM BUILDING INCLUDING, WET WALLS AND NON-CLOG PUMPS, AND $2,000,000 FOR THE GRAVITY SYSTEMS. (PB-186 000) (W70-01051).

00151. ADVANCED DEVELOPMENT OF HOUSEHOLD PUMP-STORAGE-GRINDER UNIT (TASK 6).

FARRELL, R. P.

ASCE COMBINED SEWER SEPARATION PROJECT, GENERAL ELECTRIC CO REPORT NO S-69-1038, DEC 1968, 74 P.

THIS REPORT DESCRIBES THE DEVELOPMENT, BY THE GENERAL ELECTRIC COMPANY FOR THE ASCE PROJECT, OF A 150-POUND HOUSEHOLD STORAGE-GRINDER-PUMP UNIT COMPRISING A DOMESTIC SEWAGE GRINDER AND PROGRESSING-CAVITY PUMP DRIVEN BY A 1-H H. P., 1725-R. P. M. MOTOR, AND MOUNTED ON A 58-GALLON RECEIVER TANK, MEETING CRITERIA ESTABLISHED BY THE PROJECT INVESTIGATION. THE UNIT IS CAPABLE OF DISCHARGING THROUGH A BACFLOW VALVE AND 1 1/4-IN. OUTLET AT 15-GPM AT ATMOSPHERIC PRESSURE AND 11-GPM AT 35 PSIG PRESSURE. THE ESTIMATED COST OF THE UNIT WITHOUT TANK IS $343, AND ESTIMATED TOTAL INSTALLED COSTS ARE $548 FOR NEW WORK AND $648 WHERE CUTTING AND PATCHING ARE INVOLVED. COST OF ENERGY FOR OPERATION IS ABOUT $2 PER YEAR. (PB-186 004) (W70-01048)

00152. A SYSTEMS APPROACH TO WASTE MANAGEMENT.

GIGLIO, R.J., ADRIAN, D.D.; KAMINSKY, F.C.; RIKKERS, R.F.

PROC. FOURTH AMER WATER RESOURCES CONF, NY, P 344-353, NOV 1968.

THE USE OF SYSTEMS ANALYSIS TO OPTIMIZE REGIONAL PLANNING FOR WASTE WATER SYSTEMS WAS DESCRIBED THE OBJECTIVE OF THE STUDY WAS TO DEVELOP A METHODOLOGY AND MATHEMATICAL-COMPUTER MODELS WHICH COULD AID PLANNING AGENCIES TO MAKE DECISIONS CONCERNING REGIONAL DEVELOPMENT. A REGION IN MASSACHUSETTS WAS SELECTED FOR THE PILOT APPLICATION. A WASTE SYSTEM WAS DIVIDED INTO THE FOLLOWING SUBSYSTEMS; COLLECTION FACILITIES, INTERCEPTORS, VARIOUS TYPES OF TREATMENT PLANTS, STORAGE FACILITIES AND THE STREAM. ENGINEERING AND ECONOMIC DATA WERE USED TO DESCRIBE AND MODEL EACH SUBSYSTEM. OPTIMIZATION TECHNIQUES THEN HELPED DEFINE THE MOST EFFICIENT CONFIGURATION OF SUBSYSTEMS FOR REGIONS WITH DIFFERING CHARTERISTICS. ATTENTION WAS ALSO GIVEN TO PROCEDURES FOR IMPLEMENTING THE PLANS AND EQUITABLY ALLOCATING COSTS AMONG COMMUNITIES. (W70-00898).

00153. ANALYSIS AND OPTIMIZATION OF A REVERSE OSMOSIS PURIFICATION SYSTEM--PART II. OPTIMIZATION.

FAN, L.T.; CHENG, C.Y.; HO, L.Y.S.; HWANG, C.L.; ERICKSON, L.E.

DESALINATION, 6(2), 131-152, 1969.

A MATHEMATICAL MODEL OF A REVERSE OSMOSIS WATER PURIFICATION SYSTEM THAT COULD BE USED IN PROCESS OPTIMIZATION STUDIES HAD BEEN DEVELOPED IN PART I OF THIS STUDY. IN THIS PART, THE MODEL WAS USED TO DETERMINE DESIGN AND OPERATING VARIABLES OF THE SYSTEM, WHICH MINIMIZED THE COST OF WATER PRODUCTION. SEVERAL THREE MULTISTAGE OSMOSIS SYSTEMS WERE CONSIDERED. THEY WERE (1) A MULTISTAGE OPERATION WITHOUT THE USE OF A FLOW-WORK EXCHANGER AND WITH A VARIABLE MEMBRANE AREA AT EACH STAGE, (2) A MULTISTAGE OPERATION WITHOUT THE USE OF A FLOW-WORK EXCHANGER AND WITH EQUAL MEMBRANE AT EACH STAGE, AND (3) A MULTISTAGE OPERATION WITH THE USE OF A FLOW-WORK EXCHANGER AND WITH VARIABLE MEMBRANE AREA AT EACH STAGE. IN THE OPTIMIZATION STUDY, THE RECIRCULATION RATE IN EACH STAGE, THE BRINE COMPOSITION LEAVING EACH STAGE, THE RATIO OF MEMBRANE AREA TO FEED AT EACH STAGE, AND THE OPERATING PRESSURE IN EACH STAGE WERE CONTROLLED TO ARRIVE AT A MINIMUM WATER PRODUCTION COST. THE STUDY SHOWED THAT THE METHOD PRESENTED COULD BE USED TO ACCOMPLISH OPTIMUM DESIGNS OF COMPLEX PROCESSES REQUIRING THE SIMULTANEOUS OPTIMIZATION OF SEVERAL VARIABLES. (W70-00890)

00154. COPING WITH COOLING TOWER BLOWDOWN.

HOPPE, T.C.

INDUSTRIAL WATER ENGINEERING, P 27-32, DEC 1966.

A CASE STUDY IS PRESENTED OF INDUSTRIAL COOLING WATER TREATMENT WITH INFLOW PROCESS TEMPERATURES OF 116F TO 350F, AND 90F TO 140F OUT, WITH A MAXIMUM WATER TEMPERATURE DIFFERENTIAL ACROSS THE TOWER OF 31F. WELL WATER WAS TREATED WITH ACID FOR PH CONTROL, SHOCK CHLORINATION FOR BIOCIDE, AND NON-CHROMATE PROPRIETARY BLEND OF POLYPHOSPHATES AND POLYVALENT IONS FOR CORROSION INHIBITION. OPERATING EXPERIENCE SHOWED SEVERE CORROSION AND IRON OXIDE AND PHOSPATE SLUDGE DEPOSITS. A NEW CORROSION INHIBITOR IN THE FORM OF ZINC, AND BIODEGRADABLE ORGANIC MATERIAL, WITHOUT CHROMATE NOR PHOSPHATES, WAS TRIED. VERY GOOD RESULTS WERE OBTAINED. UNIFORM PROTECTIVE FILM FORMATION WAS EVIDENT, PREVIOUS TUBERCULATION DECREASED, AND NO SLUDGE ACCUMULATED. COSTS ROSE FROM $0.0606 TO $0.1275 PER 1000 GALLONS OF MAKEUP, BUT THIS WAS FAR LESS EXPENSIVE THAN OTHER ALTERNATIVES. (W70-00884)

COST ANALYSIS OF WATER POLLUTION CONTROL

00155. NUCLEAR POWER PLANT SITING IN THE PACIFIC NORTHWEST FOR THE BONNEVILLE POWER ADMINISTRATION.

HARTY, H.; CORLETT, R.F.; BROWN, R.E.
SUMMARY RESEARCH REPORT, BATTELLE-NORTHWEST, JULY 1967.

THE FACTORS WHICH ARE TAKEN INTO ACCOUNT FOR SITE SELECTIONS ARE PHYSICAL AND ENVIRONMENTAL SITE FACTORS, POPULATION OF SURROUNDING AREAS, GEOLOGY AND HYDROLOGY, METEOROLOGY, HEAT DISSIPATION AND BIOLOGICAL EFFECTS. THE SIGNIFICANT FACTORS IN SITE COST ARE CONDENSER SIZE AND COST, NATURAL- AND INDUCED-DRAFT COOLING TOWERS, LAND AND SITE PREPARATION COSTS, SITE ACCESS, ENGINEERED SAFEGUARDS AND MULTIPLE-REACTOR SITING. FOR THE SITES CONSIDERED, THE METHOD OF HANDLING WASTE HEAT WAS THE SINGLE MOST IMPORTANT ECONOMIC VARIABLE. IT WAS FOUND THAT ONCE-THROUGH COOLING WITH FRESH WATER WAS THE MOST ECONOMICAL METHOD OF DISPOSING OF WASTE HEAT. ONCE-THROUGH COOLING WITH SALT WATER INCREASED CAPITAL COSTS ABOUT $3/KW AND UNIT POWER COSTS ABOUT 0.045 MILL/KW-HR. THE USE OF COOLING TOWERS FOR WASTE HEAT DISCHARGE INCREASED CAPITAL COSTS ABOUT $10/KW AND UNIT POWER COSTS ABOUT 0.14 MILL/KW-HR. A MAJOR ECONOMIC TRADEOFF EXISTS AMONG THE METHOD OF HANDLING WASTE HEAT, TRANSMISSION COSTS, ENGINEERED SAFEGUARDS COSTS (WHICH TEND TO INCREASE AS SITES APPROACH MANY LOAD CENTERS, I. E., URBAN AREAS), LAND COSTS (GENERALLY HIGHER NEAR URBAN AREAS) AND OTHER FACTORS. (W70-00883).

00156. ELECTRODIALYSIS IN ADVANCED WASTE TREATMENT.

SMITH, J.D.; EISENMANN, J.L.
WATER POLLUT CONTR RES SER PUB NO WP-20-AWTR-18, 219 P. FEB 1967.

A BENCH-SCALE EXPERIMENTAL STUDY WAS MADE TO DETERMINE THE PRACTICALITY OF PARTIALLY DEMINERALIZING MUNICIPAL WASTEWATER BY ELECTRODIALYSIS. USING FILTRATION ALONE AND FILTRATION FOLLOWED BY CARBON ADSORPTION AS PRETREATMENT, LONG-TERM RUNS WERE MADE WITH A MUNICIPAL SECONDARY EFFLUENT TO DETERMINE SCALING AND FOULING EFFECTS OF THE WATER UPON THE ELECTRODIALYSIS MEMBRANES. DURING THESE RUNS A STUDY WAS MADE TO DETERMINE HOW HIGH A RATIO OF PRODUCT RATE TO CONCENTRATE RATE COULD BE OBTAINED WITHOUT FORMING SCALE ON THE MEBRANES. SOME FOULING OF ANION MEMBRANES OCCURRED WITH FILTRATION AND CARBON ADSORPTION PRETREATMENT; WITHOUT CARBON ADSORPTION, FOULING WAS MUCH WORSE. SCALE FORMATION WAS NOT A PROBLEM AT PRODUCT TO CONCENTRATE RATIOS LESS THAN TEN. AT TIMES MUCH HIGHER RATIOS WERE OBTAINED WITHOUT DIFFICULTY. THE RESULTS OF THESE RUNS INDICATED THAT THE TOTAL OPERATING COST FOR A 10-MGD ELECTRODIALYSIS TREATMENT PLANT MIGHT BE LESS THAN 10 CENTS PER 1,000 GAL. (W69-00691).

00157. A COST-BENEFIT ANALYSIS OF MINE DRAINAGE.

TYBOUT, R.A.
REPRINTS OF PAP 2D SYMP ON COAL MINE DRAINAGE RES, MELLON INST, PP 334-371, MAY 1968.

COSTS OF ABATEMENT OF ACID MINE DRAINAGE FOR COAL MINES IN PENNSYLVANIA ARE CALCULATED AND CLASSIFIED BY COUNTY. ESTIMATES ARE BASED ON STATISTICAL ANALYSIS OF THE DATA FROM THE PENNSYLVANIA DEPT. OF MINES AND MINERAL INDUSTRIES' YELLOWBOY PROJECT. THE VOLUME OF MINE DRAINAGE IS ANALYZED AS A FUNCTION OF HISTORIC PATTERNS OF COAL PRODUCTION, METHODS OF MINING, SEAM THICKNESS, AND HYDROLOGIC CONDITIONS. COSTS ARE ESTIMATED FOR OTHER AREAS OF APPALACHIA BY COMPARISON WITH PENNSYLVANIA COSTS. SECONDARY COSTS OF UNEMPLOYMENT CAUSED BY CLOSING OF MINES FOR FAILURE TO TREAT WASTE SATISFACTORILY ARE ALSO ESTIMATED. BENEFITS ARE NOT EVALUATED. THE SUGGESTION IS MADE THAT IN MANY CASES TREATMENT COST IS GREATER THAN BENEFIT AND POLLUTERS IN SUCH CASES SHOULD PAY DOWNSTREAM USERS FOR DAMAGES AS AN ALTERNATIVE TO TREATMENT. ANNUAL TREATMENT COST ESTIMATES FOR ALL PENNSYLVANIA ACTIVE MINES ARE TABULATED. THE COST OF SEALING INACTIVE MINES IS ESTIMATED TO BE $18-36 MILLION. TABLES INCLUDE TREATMENT PLANT COST ESTIMATES, YELLOWBOY COST REGRESSIONS AND COST FUNCTIONS, NUMBER OF DRAINAGE MINES BY COUNTIES, VOLUME OF DRAINAGE BY COUNTIES, AVERAGE THICKNESS OF COAL SEAMS, CORRELATION MATRIX FOR UNDERGROUND AND STRIP MINES, DRAINAGE VOLUME REGRESSIONS, AND QUALITY OF DRAINAGE. (W69-00426).

00158. A COOLING POND PROVES CHEAPER.

BRASWELL, R. W.
ELECTRICAL WORLD, 140(22), 84-85, 1953.

AN ECONOMIC STUDY WAS MADE DURING THE EARLY DESIGN STAGES OF THE 210,000 KW OUTDOOR DELTA STATION NEAR CLEVELAND, MISSISSIPPI. COMPARATIVE COSTS STUDIES INDICATE THAT INITIAL CONSTRUCTION COST OF A COOLING POND WOULD BE APPROXIMATELY 10% LESS THAN THE TOWERS. ADDITIONAL ADVANTAGES OF COOLING PONDS OVER COOLING TOWERS ARE THAT IT REQUIRES LOWER MAINTENANCE COSTS AND HAS LONGER LIFE. ESTIMATES OF ANNUAL OPERATING EXPENSES INDICATED A SAVINGS OF UP TO 2% IN FAVOR OF THE COOLING POND. A DIVIDED EARTH BAFFLE APPROXIMATELY 3,000 FEET LONG AND EXTENDING OUT INTO THE POND FROM THE PLANT SIDE, WILL PROVIDE GOOD UTILIZATION OF AVAILABLE POND AREA FOR EVAPORATIVE COOLING. SLOPES WERE SEEDED BY AIRPLANE WITH RYE AND BERMUDA GRASSES FOR SOIL STABILIZATION AND PREVENTION OF EROSION. MAXIMUM FORCED EVAPORATION FROM THE PONDS HAS BEEN ESTIMATED AT 9 CFS. TWO CFS OF SEEPAGE LOSSES CAN BE EXPECTED. THE CONSTRUCTION PROJECT AND COST TO DATE INDICATE THAT DESIGN STUDIES AND ESTIMATES WERE APPROXIMATELY CORRECT. (W70-02409).

00159. PRODUCTION, DISPOSAL, AND USE OF WHEY IN VERMONT.

FIFE, C.L.; NILSON, K.M.
VERMONT UNIV AGR EXPER STA BULL 658, SEPT 1969. 20 P.

THE SEVENTEEN VERMONT CHEESE PLANTS PRODUCED 337 MILLION POUNDS OF WHEY IN 1967. ABOUT 69% WAS THE BYPRODUCT OF LOW-ACID CHEESES AND 31% THE

BYPRODUCT OF HIGH-ACID CHEESES. PRODUCTION VARIED FROM 40 MILLION POUNDS IN MAY TO 25 MILLION POUNDS IN DECEMBER. WHEY IS PROBABLY THE LARGEST SINGLE SOURCE OF STREAM POLLUTION IN THE STATE. IT ACCOUNTS FOR ABOUT 85% OF ALL INDUSTRIAL POLLUTION AND REPRESENTS A SEWAGE LOAD EQUAL TO THE DOMESTIC WASTES OF 145,000 PEOPLE. AS OF JAN. 1,1969, LEGISLATION PROHIBITS FURTHER STREAM POLLUTION. FORTY PERCENT OF THE WHEY IN THE STATE FINDS SOME ECONOMIC USE EITHER AS ANIMAL FEED OR FERTILIZER. ANOTHER 20% IS HANDLED AS SEWAGE BUT NOT DUMPED DIRECTLY INTO STREAMS. ANNUALLY THE IND4 398 7&Y0 MORE THAN $118,000 (ABOVE REVENUES) TO HANDLE WHEY AT AN AVERAGE COST OF OVER 5.7 CENTS CWT. THE COST OF DRYING HUMAN-GRADE WHEY WOULD RANGE FROM 2.8 TO 4.6 CENTS PER POUND OF POWDER. ASSEMBLING WHEY WITHIN 40 MILES OF 80% OF PRODUCTION WOULD COST ABOUT 1.5 CENTS PER POUND, AND ASSEMBLING THE REST OF THE WHEY IN THE STATE WOULD COST FROM 3.0 TO 4.0 CENTS PER POUND. UNDER CURRENT PRICE AND COST CONDITIONS, A LARGE DRYING PLANT IS FEASIBLE IF ALL WHEY WERE MADE AVAILABLE. (W70-02299)

00160. CENTRIFUGES REDUCE WATER POLLUTION.

TOWNSEND, J.R.
IND WATER ENG (IWE) 1ST ANNU AIR WATER ENG BUYERS GUILD, P 66, 1969.

CENTRIFUGES ARE USED TO REDUCE WATER CONTAMINATION BY REMOVING THE SUSPENDED WASTE PARTICLES FROM EFFLUENTS OF PAPER, MEAT RENDERING, PLASTICS OR OTHER CHEMICAL PROCESSING PLANTS. THE TYPE OF CENTRIFUGES USED DEPENDS UPON THE EFFLUENT COMPOSITION, THE DEGREE OF CLARITY DESIRED AND THE AMOUNT TO BE HANDLED. THE FOLLOWING TYPES OF CENTRIFUGES ARE BRIEFLY DESCRIBED: BASKET-TYPE, PERFORATED-WALL, DISC CENTRIFUGES, AND SOLID-BOWL CONTINUOUS-DISCHARGE MACHINES. THE COMPARISON OF VARIOUS CENTRIFUGES WITH REGARD TO COST AND EFFICIENCY SHOULD INCLUDE: ORIGINAL EQUIPMENT COST, COST OF MONEY, PERIOD OF ASSUMED AMORTIZATION, CAPACITY OF THE CENTRIFUGE, COST OF POWER, INSTALLATION COST, PLANT SPACE, MANHOURS REQUIRED TO CLEAN THE CENTRIFUGES, AND PERSONNEL COSTS. (W70-02295)

00161. DYNAMIC OPTIMIZATION FOR INDUSTRIAL WASTE TREATMENT DESIGN.

SHIH, C.S.; KRISHNAN, P. A.
J WATER POLLUT CONTR, 41(10), 1787-1802, 1969.

THE DYNAMIC PROGRAMMING TECHNIQUE WAS USED FOR THE SYSTEM OPTIMIZATION OF AN INDUSTRIAL WASTEWATER TREATMENT DESIGN. A SERIAL MULTI-STAGE SYSTEM WITH TWO POINT BOUNDARY VALUES WAS UTILIZED. THE OBJECTIVE OF THE OPTIMIZATION WAS TO IDENTIFY THE OPTIMUM COMBINATIONS AND EFFICIENCIES OF VARIOUS UNIT PROCESSES IN A MULTI-STAGE TREATMENT PLANT MEETING THE ULTIMATE DESIGN REQUIREMENTS. THE PRINCIPLES OF DYNAMIC PROGRAMMING WERE REVIEWED BRIEFLY. THEN, BASED ON THE WASTEWATER TREATMENT DESIGN PRINCIPLES, THE ECONOMIC OPTIMIZATION SCHEME FOR THE PLANT DESIGN WAS FORMULATED WITH THE INTEGRATION OF DYNAMIC PROGRAMMING TECHNIQUES. A SPECIFIC CASE IN PULP AND PAPER WASTEWATER TREATMENT WAS PRESENTED FOR ILLUSTRATION. THE COST FUNCTIONS USED IN THE EXAMPLE WERE COMPILED ON THE BASIS OF PROCESS DESIGN AND ENGINEERING EVALUATIONS. FURTHER REFINEMENT OF THE PROCEDURE DEVELOPED IN THE STUDY TO MAKE IT A STANDARD APPROACH WAS ENCOURAGED. (W70-02261)

00162. REPORT ON DEVELOPMENT OF A MATHEMATICAL MODEL FOR MINIMIZING CONSTRUCTION COSTS IN WATER POLLUTION CONTROL.

CAMP, DRESSER AND MCKEE, BOSTON, MASS, JUNE 1969. 207 P.

A METHOD WAS DEVELOPED FOR THE DETERMINATION OF A LEAST COST CONSTRUCTION PROGRAM TO ACHIEVE WATER POLLUTION CONTROL OBJECTIVES WITHIN A DRAINAGE BASIN. THE METHOD WAS TO ACCOMPLISH FOUR SPECIFIC PURPOSES, (A) TO MINIMIZE THE OVERALL COOSTS BASED ON COST OF TREATMENT PLANTS; (B) TO PROVIDE A METHOD FOR DETERMINING THE MINIMUM COST FOR ACHIEVING INTERMEDIATE GOALS; (C) TO DEVLOP A MEANS OF DETERMINING WHAT WATER QUALITY IMPROVEMENTS COULD BE EXPECTED FROM THE EXPENDITURE OF STATED LIMITED FUNDS, AND (D) TO DEVELOP A METHOD WHICH WOULD PROVIDE THE STATE AND FEDERAL AGENCIES WITH CLEARLY DEFINED ALTERNATIVE PROGRAMS. SIMULATION PROGRAMS AND A MIXED INTEGER PROGRAMMING MATHEMATICAL MODEL WERE EMPLOYED FOR OPTIMIZING PURPOSES. TWO INDEPENDENT COMPUTER PROGRAMS WERE DEVELOPED WHICH TOGETHER DETERMINED THE MINIMUM COMBINATION OF TREATMENT PLANTS TO ACHIEVE SPECIFIED QUALITY STANDARDS ALONG THE MAIN STEM OF A RIVER. THE MERR-MACK-PEMIGEWASSETT RIVER WAS SELECTED FOR THE DEMONSTRATIVE OF THE USEFULNESS OF THE PROPOSED METHOD OF ANALYSIS IN A REAL SITUATION. (W70-02258).

00163. CENTRIFUGATION OF WASTE SLUDGES.

ALBERTSON, O.E.; GUIDI, E.E. JR.
J WATER POLLUTION CONTROL FED., 41(4), 607-628, 1969.

SLUDGE CENTRIFUGATION WITH A DESCRIPTION OF THE PRINCIPLES OF THE CENTRIFUGE ARE REVIEWED. RESULTS OF TESTS ON THE SOLID BOWL PROCESS VARIABLES OF FEED RATE, PARTICLE SIZE AND DENSITY, FEED CONSISTENCY, TEMPERATURE AND CHEMICAL AIDS ARE REPORTED. THE TESTS WERE RUN AT 70 SITES THROUGHOUT THE U. S. A. ON RAW PRIMARY AND SECONDARY SLUDGES, DIGESTED PRIMARY AND SECONDARY PULP AND PAPER WASTES AND WATER SOFTENING SLUDGES. THE RESULTS OF THE TESTS INDICATE THAT A LONG-BOWL CENTRIFUGE CAN HANDLE ALL TYPES OF SLUDGES AND CAN PRODUCE A SOLIDS CONCENTRATION AS HIGH AS OR HIGHER THAN VACUUM FILTERS AT COSTS NOT EXCEEDING THOSE FOR VACUUM FILTRATION. THE USE OF CENTRIFUGATION FOR DEWATERING SLUDGES WILL INCREASE BECAUSE OF MACHINE IMPROVEMENTS. (W70-02199).

00164. TREATMENT OF COMBINED SEWER OVERFLOWS AND SURFACE WATERS AT CLEVELAND, OHIO.

SIMPSON, G.D.; CURTIS, L.W.
J WATER POLLUT CONTR FEDERATION, 41(2) PART 1, P 151-168, 1969.

A FEASIBILITY STUDY WAS CONDUCTED ON A 30,000 ACRE FEET (37 MILLION CUBIC METER) RETENTION-STABILIZATION BASIN AT CLEVELAND, OHIO. THE BASIN WOULD HOLD THE COMBINED WASTES IN A PARTITIONED SECTION OF LAKE ERIE FOR BIO-OXIDATION, SEDIMENTATION AND DISINFECTION. THE AREA OF THE BASIN WOULD BE 900 ACRES AND THE AVERAGE DEPTH 34 FEET. THE OXIDATION AND SEDIMENTATION WOULD BE CARRIED OUT IN SEPARATE SECTIONS. THE COSTS FOR THE BASIN AND COLLECTION SYSTEM WOULD BE $83.5 MILLION (1968). THE COST OF THIS METHOD OF TREATMENT WOULD BE

ABOUT 1/3 OF THAT FOR SEPARATION OF THE SEWER SYSTEM AND TREATMENT BY CONVENTIONAL METHODS. (W70-02195).

00165. ECONOMICS OF WASTEWATER TREATMENT.

ECKENFELDER, W.W.; FORD, D.L.
CHEM ENG, 76(18), 109-118, 1969.

WASTEWATER CHARACTERISTICS ARE DESCRIBED FROM VARIOUS TYPES OF CHEMICAL INDUSTRIES, THE TYPES OF TREATMENT WHICH ARE LIKELY TO BE REQUIRED, AND THE COSTS FOR SUCH TREATMENT UNITS AND PLANTS. THE COSTS ARE RELATED TO THE INITIAL AND FINAL QUALITIES OF THE WASTEWATER TO BE TREATED AND TO THE SIZE OF THE PLANTS. CURVES ARE SHOWN FOR THE COST OF THE VARIOUS UNIT PROCESSES VERSUS SIZE. AN EXAMPLE IS WORKED FOR A CONVENTIONAL ACTIVATED SLUDGE PLANT WITH A DAILY FLOW OF 2.5 MGD. (W70-02191).

00166. TERTIARY TREATMENT BY MICROSTRAINING.

DIAPER, E.W.J.
WATER AND SEWAGE WORKS, 116(6), 202-207, 1969.

A WOVEN STAINLESS STEEL CLOTH AROUND THE PERIPHERY OF A PARTIALLY SUBMERGED DRUM IS USED TO STRAIN THE EFFLUENT OF WASTE TREATMENT PLANTS. THE DRUM ROTATES AT A VARIABLE SPEED AND THE COLLECTED MAT IS BACKWASHED FROM THE TOP OF THE DRUM INTO A COLLECTOR. THE CLOTH IS AVAILABLE WITH OPENINGS OF 60,35, AND 23 MICRONS, BUT IT REMOVES MUCH SMALLER PARTICLES BECAUSE OF THE MATTING. A NUMBER OF INSTALLATIONS ARE DESCRIBED. THE ARTICLE GIVES AVAILABLE SIZES (TO 10 MGD) AND COSTS (INSTALLED COSTS OF $24,000 TO $45,000 PER MGD AND OPERATING COSTS OF $2.50 TO $4.00 PER MG) FOR MICROSTRAINERS. (W70-02186).

00167. THE PRACTICALITY OF USING ATOMIC RADIATION FOR WASTEWATER TREATMENT.

BALLATINE, D.S.; MILLER, L.A.; BISHOP, D.F.; ROHRMAN, F.A.
J WATER POLLUTION CONTROL FED., 41(3), PART 1, 445-458, 1969.

APPLICATION OF ATOMIC RADIATION TO WASTEWATER TREATMENT ARE DESCRIBED AND THE PROBABLE COSTS FOR SUCH TREATMENT ARE GIVEN. THEY DISCUSS 4 POSSIBLE APPLICATIONS, THEY ARE AS FOLLOWS: (A) SLUDGE HANDLING AND DEWATERING, (B) DESTRUCTIVE OXIDATION OF ORGANICS, (C) DISINFECTION, AND (D) BREAKDOWN OF REFRACTORY MOLECULES. THE RADIATION SOURCES WHICH WERE CONSIDERED ARE COBALT-60, CESIUM-137, ACCELERATORS, REACTOR LOOPS, SPENT FUEL ELEMENTS, AND MIXED FISSION PRODUCTS. THE ESTIMATED TREATMENT COSTS OF $0.13 TO $1.58 PER 1000 GAL ARE NOT CONSIDERED COMPETITIVE FOR MOST APPLICATIONS. SLUDGE BENEFICIATION COMES CLOSEST TO PRACTICALITY AT THE PRESENT TIME. (W70-02185).

00168. OPERATION AND MAINTENANCE OF MUNICIPAL WASTE TREATMENT PLANTS.

MICHEL, R.L.; PELMOTER, A.L.; PALANGE, R.C.
J WATER POLLUTION CONTROL FED., 41(3), PART 1, 335-354, 1969.

THE OPERATION AND MAINTENANCE OF THE FEDERALLY ASSISTED WASTEWATER TREATMENT PLANTS FROM JULY 1962 THROUGH DECEMBER 1964 ARE DESCRIBED. TABLES OF OPERATING COSTS, PROCESS VARIABLES, PRACTICES, AND OTHER TREATMENT-RELATED PARAMETERS ARE INCLUDED. THE CONCLUSIONS REACHED ARE THE FOLLOWING: (A) PER CAPITA VALUES OF RAW BOD, FLOW, AND SUSPENDED SOLIDS INCREASE GEOMETRICALLY WITH POPULATION A FACTOR OF 2 X OF THOSE FOR 50,000 TO 100,000 OVER THOSE FOR 5000 TO 10,000, (B) OPERATING COSTS OF STABILIZATION PONDS ARE 10 TO 16% OF THOSE FOR MECHANICAL PLANTS, AND (D) COSTS WILL RISE SHARPLY WITH MORE SOPHISTICATED TREATMENT. THE MOST FREQUENT PROBLEM OF OPERATION AND MAINTENACE WAS THE BYPASSING OF UNTREATED WASTE WATER. OTHER PROBLEMS ARE ALSO DISCUSSED. (W70-02180).

00169. OZONE TREATMENT OF SECONDARY EFFLUENTS FROM WASTE-WATER TREATMENT PLANTS.

HUIBERS, D.TH. A.; MCNABNEY, R.; HALFON, A.
ROBERT A. TAFT RESEARCH CENTER REPORT NO. TRWC-4, FEDERAL WATER POLLUTION CONTROL ADMINISTRATION ADVANCED WASTE TREATMENT LABORATORY, APRIL 9, 1969.

OZONE EFFECTIVELY LOWERS THE CHEMICAL OXYGEN DEMAND AND TOTAL ORGANIC CARBON CONTENT OF EFFLUENTS FROM WASTEWATER TREATMENT PLANTS. IT REMOVES ODORS AND COLOR FROM WATER AND DESTROYS PATHOGENIC ORGANISMS. TERTIARY TREATMENT WITH OZONE HAS THE POTENTIAL OF AN AUTOMATED, TROUBLE-FREE OPERATION WITH LOW MAINTENANCE. AN EFFICIENT CONTACTING PROCESS AND A PRELIMINARY EVALUATION OF ITS ECONOMICS WERE INVESTIGATED. OZONATION WAS FIRST STUDIED BY LOW-SHEAR COUNTERCURRENT CONTACTING IN AN 18-FT COLUMN PACKED WITH RASCHIG RINGS. LATER IT WAS FOUND THAT THE RATES OF COD AND TOC REMOVAL COULD BE CONSIDERABLY INCREASED BY HIGH-SHEAR CONTACTING USING A TURBINE AGITATOR. THE OPTIMUM TREATMENT OF SECONDARY EFFLUENT WITH OZONE REQUIRED MULTISTAGE COCURRENT CONTACTING. A SIX-STAGE SYSTEM WAS SIMULATED BY MIXING THROUGH THE 18-FT PACKED TOWER. OVERALL EFFICIENCES AS HIGH AS 90% WERE OBTAINED. THE ESTIMATED TREATMENT COST IS 7.7 CENTS/1000 GAL TO REDUCE THE COD FROM 35 MG/L TO 15 MG/L ASSUMING AN 80% OZONE UTILIZATION EFFICIENCY IN A 10 MGD PLANT. THIS IS ABOUT EQUAL TO THE ESTIMATED COST FOR TREATMENT WITH ACTIVATED CARBON. CHEMICAL CLARIFICATION OF THE SECONDARY EFFLUENT PRIOR TO TREATMENT WITH OZONE WOULD REDUCE OZONE CONSUMPTION AND RESULT IN A LOWER FINAL COD AND TOC. (W70-02118).

REFERENCE LIST

00170. A MODEL FOR QUANTIFYING FLOW AUGMENTATION BENEFITS. FINAL REPORT.

PYATT, E.E.; HEANEY, J.P.; GRANTHAM, G.R.; CARTER, B.J.
FINAL REPORT TO FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, USDI SOUTHEAST REGION, ATLANTA, GA, SEP 1969. 630 P.

WITH INCREASING QUANTITATIVE AND QUALITATIVE DEMANDS BEING PLACED UPON NATIONAL WATER RESOURCES, IMPROVED MANAGEMENT PRACTICES ARE VITALLY NEEDED. IN PRINCIPLE, ONE POWERFUL MANAGEMENT TOOL IS SYSTEMS ANALYSIS, WHEREIN MATHEMATICAL OPTIMIZING TECHNIQUES ARE EMPLOYED TO EFFECT RATIONAL TRADEOFFS BETWEEN COMPETING DEMANDS FOR WATER USE, BUT THIS TOOL, IN TURN, RESTS UPON THE AVAILABILITY OF METHODOLOGIES FOR QUANTIFYING THE BENEFITS (ECONOMIC VALUE) OF EACH WATER-USE CATAGORY. THAT IS, SYSTEMS ANALYSIS, BEFORE IT CAN BE EMPLOYED COMPREHENSIVELY, DEMANDS A KNOWLEDGE OF THE FUNCTIONAL VALUE OF IRRIGATION, FLOOD CONTROL, MUNICIPAL WATER SUPPLY, ETC. LITTLE IS KNOWN OF THE ECONOMIC IMPLICATIONS OF LOW FLOW AUGMENTATION, ONE OF THE IMPORTANT WATER-USE CATEGORIES. BEGINNING WITH THE PREMISE THAT THE VALUE OF LOW FLOW AUGMENTATION IS MEASURED BY SEWAGE TREATMENT COSTS AVOIDED, A HYDROLOGIC FLOW SIMULATOR AND A WATER QUALITY LINEAR PROGRAMMING MODEL WERE INTERFACED TO DEVELOP A PROCEDURE FOR DETERMINING 'WILLINGNESS TO PAY' FOR AUGMENTATION. THIS GENERALIZED APPROACH CAN BE APPLIED BY OTHERS TO THEIR SPECIFIC WATER POLLUTION CONTROL SITUATIONS. (PB-188 208) (W70-02039).

00171. DISPOSAL OF DIGESTED SLUDGE TO PUGET SOUND--THE ENGINEERING AND WATER QUALITY ASPECTS, JULY, 1965.

MUNICIPALITY OF METROPOLITAN SEATTLE, KING COUNTY, WASHINGTON, JULY 1965. 75 P.

THE DISPOSAL OF DIGESTED SLUDGE FROM THE WEST POINT AND RENTON WASTEWATER TREATMENT PLANTS SERVING METROPOLITAN SEATTLE BY DILUTION IN THE WATERS OF PUGET SOUND IS RECOMMENDED. THE MUNICIPALITY'S STAFF AND CONSULTANTS AGREE THAT THE QUALITY OF THE RECEIVING WATER CAN BE SUITABLY MAINTAINED FOR OTHER BENEFICIAL USES AND THAT THE PUBLIC HEALTH AND WELFARE WILL BE PROTECTED. A COMPREHENSIVE WATER QUALITY MONITORING PROGRAM IS BEING ESTABLISHED. THE DIGESTED SLUDGE WOULD BE SCREENED TO REMOVE OBJECTIONABLE FLOATABLE MATERIALS, MIXED WITH EFFLUENT FROM THE PRIMARY TREATMENT PLANT, AND CHLORINATED PRIOR TO DISPOSAL INTO THE SOUND THROUGH A 96 INCH DIAMETER SUBMERGED OUTFALL SEWER. JET MIXING WITH SEA WATER BY A DIFFUSER IN THE SEWER WILL PRODUCE A DILUTION OF MORE THAN 10,000 TO ONE UPON DISCHARGE. ULTIMATE DISAPPEARANCE OF THE SLUDGE WILL RESULT FROM COMBINED EFFECTS OF FURTHER VOLATILIZATION, HYDRODYNAMIC DISPERSION, SEDIMENTATION AND FLUSHING TO THE OCEAN. LITTLE BUILDUP OF DIGESTED SLUDGE SOLIDS ON THE BOTTOM OF THE SOUND IS PREDICTED. THE SLUDGE DISPOSAL METHOD PROPOSED IS BELIEVED TO BE THE MOST PRACTICAL AND ECONOMICAL OF VARIOUS ALTERNATIVES CONSIDERED. SIMILAR SLUDGE DISPOSAL METHODS ARE PRACTICED SUCCESSFULLY AT LOS ANGELES. (W70-02031)

00172. OIL WASTE DISPOSAL FACILITY STUDY, SEATTLE AREA.

EDWARDS, W.J.; WARD, N.C.
MUNICIPALITY, METROPOLITAN SEATTLE, ENGINEERING REPORT, AUG 1969, 51 P.

THE ENGINEERING REPORT PRESENTS THE SCOPE OF THE OIL WASTE DISPOSAL PROBLEM, SOLUTIONS THERETO, DANGERS OF CONTAMINATION OF UNDERGROUND AND SURFACE WATERS AND DETAILS OF DESIGN, OPERATION, ADMINISTRATION AND FINANCE OF A RECOMMENDED TREATMENT FACILITY FOR OIL WASTES. THE STUDY, FINANCED BY FOUR PUBLIC AGENCIES IN THE SEATTLE AREA INCLUDING THE STATE, WAS INITIATED AS THE RESULT OF AN ILLEGAL DISCHARGE OF OIL, IN 1967, INTO THE SEWER SYSTEM OF THE MUNICIPALITY OF METROPOLITAN SEATTLE. OIL WASTES GENERATED ANNUALLY IN THE GREATER SEATTLE AREA (TACOMA TO EVERETT) TOTAL 9.3 MILLION GALLONS. PRINCIPLE SOURCES ARE AUTOMOTIVE, SHIP AND TANK CLEANING, AND INDUSTRIAL. RECLAMATION AND REUSE OF THE OIL WASTES, WHEN FEASIBLE, IS CITED AS THE MOST DESIRABLE PROCEDURE TO PREVENT POLLUTION. LIMITATIONS OF CURRENT DISPOSAL PROCEDURE ARE DISCUSSED--INCLUDING LANDFILLING, BARGING TO SEA, INCINERATION AND SUBSURFACE INJECTION. THE BASIC RECOMMENDATION IS THAT A LOCAL PUBLIC AGENCY CONSTRUCT AND OPERATE A CENTRAL FACILITY FOR DISPOSING OF OIL WASTES BROUGHT THERE BY ANYONE. TOTAL ANNUAL COST OF THE FACILITY WAS ESTIMATED TO BE $105,000. A CHARGE OF 3.5 CENTS PER GALLON OF WASTES RECEIVED IS RECOMMENDED TO MAKE THE PLANT SELF-SUPPORTING. THE SUGGESTED FACILITY, WHEN COMPLETED, WOULD BE UNIQUE. FEDERAL DEMONSTRATION GRANT FUNDS ARE MENTIONED. DRAWINGS, TABLES AND BIBLIOGRAPHY ARE INCLUDED. (W70-02030)

00173. INCINERATION OF GRIT, SCREENINGS, AND SCUM.

REPORT, METROPOLITAN SANITARY DISTRICT, GREATER CHICAGO, FEB 1969. 77 P.

DETAILED STUDIES AND A PRELIMINARY DESIGN OF AN INCINERATION SYSTEM FOR THE DISPOSAL OF GRIT, SCREENING, AND SCUM FROM ALL OF THE WASTEWATER TREATMENT PLANTS OF THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO ARE REPORTED BY A FIRM OF CONSULTING ENGINEERS. THE STUDY INCLUDED: (1) DETERMINATION OF QUANTITIES AND CHARACTERISTICS OF THE WASTE MATERIALS, (2) MATERIAL HANDLING PROBLEMS, (3) INCINERATION PROCESSES, AND (4) DESIGN, LAYOUT, AND COST ESTIMATES OF THE PROPOSED SYSTEM. THE REPORT PROPOSES THE CONSTRUCTION OF AN INCINERATOR AT THE DISTRICT'S SOUTHWEST TREATMENT WORKS CAPABLE OF HANDLING 250 TONS (WET) DAILY. CONTAINERIZED TRUCK HAULING OF GRIT, SCREENINGS, AND SCUM FROM OUTLYING DISTRICT TREATMENT PLANTS TO THE SOUTHWEST PLANT IS RECOMMENDED, BASED UPON COST COMPARISONS WITH OTHER METHODS. AN INCINERATOR PROPOSED IS A 7-HEARTH FURNACE DESIGNED TO MEET ANTICIPATED AIR POLLUTION REGULATIONS AND ESTIMATED LOAD REQUIREMENTS IN THE YEAR 1985. A WASTE-HEAT RECOVERY SYSTEM IS CONSIDERED FEASIBLE AND IS RECOMMENDED (OPTIMAL) FOR SPACE HEATING, MATERIAL THAWING, AND FOR USE IN THE PLANT'S POWER HOUSE. CONSTRUCTION COSTS (1970) ARE ESTIMATED AT $2,631,000, AND ANNUAL OPERATING AND MAINTENANCE COSTS, $138,600. (W70-02029)

00174. EFFLUENTS AND AFFLUENCE.

HAZELTON, J.E.
NEW ENGLAND BUSINESS REVIEW, P 2-9, JUNE 1965. 8 P.

THIS ARTICLE DESCRIBES THE ZONING APPROACH USED BY THE NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT. THIS REGIONAL AUTHORITY CLASSIFIES SECTIONS OF RIVERS AND STREAMS ACCORDING TO A SCALE OF POTENTIAL WATER USES, BALANCING THE COSTS OF TREATMENT AND DUMPING RESTRICIONS AGINST THE BENEFITS THAT VARIOUS KINDS OF WATER USE BRING TO THE COMMUNITY. AN ATTEMPT IS MADE TO ESTIMATE THE PROGRESS IN WATER POLLUTION CONTROL THROUGH THE INCREASED NUMBER OF TREATMENT PLANTS CONSTRUCTED. THE ROLE OF THE FEDERAL AND STATE GOVERNMENTS IS REVIEWED. THE ARTICLE CONCLUDES WITH SOME RECOMMENDATIONS FOR NECESSARY CHANGES IN THE AREA. (W70-02012)

00175. WATER QUALITY MANAGEMENT BY REGIONAL AUTHORITIES IN THE RUHR AREA.

KNEESE, A. V.
CONTROLLING POLLUTION, ENGLEWOOD CLIFFS, N. J. PRENTICE HALL, P 109-129, 1967.

IN THIS ARTICLE THE AUTHOR DESCRIBES HOW POLLUTION HAS BEEN SUCCESSFULLY CHECKED BY A METHOD WHICH COMBINES REGIONAL COOPERATION AND MANAGEMENT WITH A SYSTEM OF ECONOMIC CHARGES TO POLLUTERS. A REVIEW OF THE BACKGROUND AND CONCEPTS UNDERLYING WATER QUALITY MANAGEMENT IN THE UNITED STATES IS PROVIDED WITH THE CONCLUSION THAT ACHIEVING CLEAN STREAMS WILL INVOLVE PUBLIC INVESTMENT FAR HIGHER THAN IN ANY OTHER FIELD OF RESOURCES DEVELOPMENT OR CONSERVATION. THIS PROVIDES THE FRAMEWORK FOR DISCUSSION OF THE GERMAN EXPERIENCE. THE COST ASSESSMENT PROCEDURES AND EFFLUENT CHARGES ARE OUTLINED. GENERALLY, IT IS FOUND THAT ECONOMIC INCENTIVES HAVE BEEN USED SUCCESSFULLY TO CONTROL THE POLLUTION OF MANUFACTURES AND MUNICIPALITIES. THE ARTICLE CONCLUDES, HOWEVER, WITH A DISCUSSION OF SOME OF THE DIFFICULTIES AND DEFICIENCIES IN THIS METHOD OF POLLUTION CONTROL. (W70-02004).

00176. PRIMARY TREATMENT OF POTATO PROCESSING WASTES WITH BYPRODUCT FEED RECOVERY.

GRAMES, L.M.; KUENEMAN, R.W.
J WATER POLLUTION CONTROL FED., 41(7), 1358-1367, 1969.

THE RESULTS ARE REPORTED OF AN INVESTIGATION BY AN ENGINEERING COMMITTEE WHICH THE IDAHO POTATO PROCESSORS ASSOCIATION FORMED TO LOOK INTO DIFFERENT METHODS OF PRIMARY TREATMENT TO SOLVE A POLLUTION PROBLEM CREATED BY THE OPERATION OF PROCESSING PLANTS ALONG THE SNAKE RIVER. PILOT-PLANT TESTS DEVELOPED A PRIMARY TREATMENT SCHEME INCLUDING AN OPTINAL GREASE-REMOVAL UNIT, POTATO WASTE CLARIFIER, AND BELT-TYPE VACUUM FILTER. THE AUTHORS REPORT THAT THE APPROACH ADOPTED BY THE POTATO PROCESSING INDUSTRY IN IDAHO FOR THE SOLUTION OF THE PROBLEM HAS BEEN HIGHLY SUCCESSFUL, THAT A PRIMARY TREATMENT SYSTEM WITH HIGH EFFICIENCY HAS BEEN PRODUCED, AND THAT FACILITIES HAVE RESULTED IN THE REMOVAL OF WASTE FROM THE WATERS OF THE STATE OF IDAHO EQUIVALENT TO A POPULATION OF MORE THAN THREE MILLION. DEWATERED SLUDGE IS SOLD PROFITABLY AS CATTLE FEED. (W70-01990)

00177. REMOVAL OF NITROGEN AND PHOSPHORUS FROM WASTE WATER.

ELIASSEN, R.; TCHOBANOGLOUS, G.
ENVIRON SCI TECHNOL, 3(6), 536-541, 1969.

THE PRINCIPAL SOURCES OF NITROGEN AND PHOSPHORUS IN WASTEWATERS ARE TABULATED WITH THE AMOUNTS FROM EACH SOURCE. DOMESTIC AND AGRICULTURAL OPERATIONS ARE ON A PAR WITH INDUSTRIAL OUTPUT FOR NITROGEN DISCHARGES, BUT PHOSPHORUS RELEASES BY INDUSTRY ARE NOT AVAILABLE. NITROGEN REMOVAL MAY BE DONE BY THE FOLLOWING PROCESSES WITH REMOVAL EFFICIENCIES AND COST IN DOLLARS PER MILLION GALLONS IN PARENTHESES: AMMONIA STRIPPING (80-98, 9-25), ANAEROBIC DENITRIFICATION (60-95, 25-30), ALGAE HARVESTING (50-90, 20-35) AND CONVENTIONAL BIOLOGICAL TREATMENT (30-50, 30-100). A SIMILAR LIST FOR PHOSPHORUS REMOVAL FOLLOWS: MODIFIED ACTIVATED SLUDGE (60-80, 30-100), CHEMICAL PRECIPITATION (88-95, 10-70), CHEMICAL PRECIPITATION WITH FILTRATION (95-98, 70-90), AND ADSORPTION (90-98, 40-70). IN ADDITION, THE CONVENTIONAL BIOLOGICAL TREATMENT REMOVES 10-30 PERCENT OF THE PHOSPHORUS. A LIST OF THE TREATMENT SCHEMES FOR REMOVAL OF BOTH NITROGEN AND PHOSPHORUS IS THE FOLLOWING: ION EXCHANGE (80-92, 86-98, 170-300), ELECTROCHEMICAL TREATMENT (80-95, 4-8 FOR POWER), ELECTRODIALYSIS (30-50, 100-250), REVERSE OSMOSIS (65-95, 250-400), DISTILLATION (90-98, 400-1000), AND LAND APPLICATION (60-90 PHOSPHORUS, 75-150). ULTIMATE DISPOSAL METHODS MAY BE CLASSIFIED INTO 4 GROUPS: DUMPING, SUBSURFACE INJECTION, CONVERSION AND DUMPING, AND CONVERSION, PRODUCT RECOVERY, AND DUMPING. (W70-01981).

00178. PHOSPHATE REMOVAL BY A LIME-BIOLOGICAL TREATMENT SCHEME.

SCHMID, L.A.; MCKINNEY, R.E.
J WATER POLLUTION CONTROL FED., 41(7), 1259-1276, 1969.

A PROCESS (BASED ON LABORATORY STUDIES) IS PROPOSED FOR THE REMOVAL OF PHOSPHORUS FROM DOMESTIC WASTEWATER BY LIME TREATMENT OF EFFLUENT BY A HIGH-RATE, COMPLETE MOX ACTIVATED SLUDGE PROCESS. THIS TREATMENT ALLOWS FOR PARTICLE REMOVAL OF THE PHOSPHORUS BY THE LIME WITH THE ACTIVATED SLUDGE ORGANISMS REMOVING THE REMAINING PORTION BY SYNTHESIS INTO CELL MASS. THE ADDITION OF 150 MG/L CALCIUM HYDOIXIDE TO RAW WASTE-WATER RESULTED GENERALLY IN A PH OF 9.5, PHOSPHATE REMOVALS OF 80 PERCENT, BOD REMOVALS OF 60 PERCENT, AND SS REMOVALS OF 90 PERCENT. THE ACTIVATED SLUDGE PROCESS WAS FOUND TO OPERATE SATISFACTORILY ON THE LIME-TREATED WASTEWATER, AND MICROBIAL PRODUCTION OF CARBON DIOXIDE IN THE ACTIVATED SLUDGE UNIT WAS SUFFICIENT TO MAINTAIN A PH NEAR NEUTRAL IN THE AERATION COMPARTMENT. (W70-01976).

00179. HOW TO BEAT THE HEAT IN COOLING WATER.

KOFLAT, T.D.
ELECTRICAL WORLD, 170(16), 31-33.

ONE METHOD PROPOSED FOR HOLDING DOWN THE HEATING EFFECT IS TO DISSIPATE IT TO A GREATER VOLUME OF WATER. FOR EXAMPLE THE HEAT DISCHARGED FROM A 1000 MW PLANT WILL ADD 30F TO A 1000 CFS FLOW, 3F TO 10,000 CFS FLOW AND 0.3F TO 100,000 CFS. ANOTHER APPROACH IS TO SELECT THE OPTIMUM CONDENSER RISE INDEPENDENT OF DILUTION CONSIDERATIONS AND DILUTE THE WATER AFTER IT LEAVES THE CONDENSER.

IN MANY AREAS THE NATURAL ROLLING TOPOGRAPHY LENDS ITSELF TO BUILDING RESERVOIRS FOR COOLING WATER WHICH CAN PROVIDE RECREATIONAL BENEFITS ALSO. A COOLING TOWER ATTEMPTS TO ACCELERATE THE NATURAL COOLING PROCESS. COOLING-TOWER PERFORMANCE IS A FUNCTION OF RANGE AND APPROACH. IN GENERAL, THE MECHANICAL-DRAFT WET-TYPE TOWER WILL HAVE AN OPTIMUM RANGE OF 21F AND AN APPROACH OF 18F, THE NATURAL-DRAFT WET-TYPE A RANGE OF 26F AND AN APPROACH OF 18F, THE MECHANICAL DRY-TYPE A RANGE OF 12F AND AN APPROACH OF 31F AND NATURAL-DRAFT DRY-TYPE A RANGE OF 17F AND AN APPROACH OF 38F. (W70-01915).

00180. OPTIMIZATION OF THE ION FLOTATION OF DICHROMATE.

GRIEVES, R.B.; ETTELT, G.A.; SCHRODT, J.T.; BHATTACHARYYA, D.

ASCE, J SANIT ENG DIV, 95(SA3), 515-525, 1969.

THE EFFICIENCY OF A PILOT-PLANT SCALE, DISSOLVED-AIR ION FLOTATION UNIT FOR THE REMOVAL AND CONCENTRATION OF DICHROMATE WAS EVALUATED. THE EVALUATION WAS DEPENDENT ON THREE VARIABLES: THE FRACTIONAL FLOTATION (REMOVAL) OF DICHROMATE, THE ENRICHMENT RATIO FOR DICHROMATE, AND THE FRACTIONAL FLOTATION (REMOVAL) OF SURFACTANT. EACH DEPENDENT VARIABLE WAS RELATED ANALYTICALLY TO FIVE INDEPENDENT VARIABLES BY MULTIPLE REGRESSION ANALYSIS. OPTIMUM VALUES OF THE INDEPENDENT VARIABLES WERE DETERMINED AND A CHEMICAL COST ESTIMATE BASED ON THE REMOVAL OF CHROMIUM WAS CARRIED OUT. THE PRIME ADVANTAGE OF THE ION FLOTATION PROCESS WAS THE CONCENTRATION OF THE CHROMIUM PRESENT IN THE WASTE (TOGETHER WITH THE SURFACTANT ADDED) IN A SMALL LIQUID VOLUME LESS THAN ONE PER CENT OF THE VOLUME OF THE WASTE. (W70-01768).

00181. SYSTEMS ANALYSIS FOR OPTIMAL WATER QUALITY MANAGEMENT.

SMITH, E.T.; MORRIS, A.R.

J WATER POLLUTION CONTROL FED., 41(9), 1635-1646, 1969.

A COMPREHENSIVE STUDY OF THE DELAWARE ESTUARY WAS UNDERTAKEN IN 1961 WITH THE FOLLOWING OBJECTIVES: (A) TO DEVELOP METHODS OF WATER QUALITY MANAGEMENT, (B) TO DETERMINE THE CAUSE AND EFFECT RELATIONSHIP BETWEEN POLLUTION FROM ANY SOURCE AND THE DETERIORATED QUALITY OF WATER IN THE ESTUARY AND (C) TO PREPARE A PROGRAM FOR THE IMPROVMENT AND MAINTENANCE OF THE WATER QUALITY IN THE ESTUARY WAS DEVELOPED WHICH EMBODIED THE CAUSE AND EFFECT RELATIONSHIPS AND CONTROL PROGRAMS BASED ON COST ALLOCATION, COST MINIMIZATION AND ZONED-OPTIMIZATION MODELS. THE OPTIMIZATION MODEL OF THE ESTUARY WAS FORMULATED AS A COMBINATION OF THE UNIFORM TREATMENT AND THE COST MINIMIZATION PROGRAMS. ONE OF THE MOST SIGNIFICANT CAUSE AND EFFECT RELATIONSHIPS EVALUATED WAS THAT BETWEEN BIOCHEMICAL OXYGEN DEMAND AND DISOLVED OXYGEN. FOR ANY GIVEN OBJECTIVE SET THE COST MINIMIZATION MODEL YIELDED THE SMALLEST COST AND UNIFORM TREATMENT MODEL YIELDED THE LARGEST. CERTAIN MONETARY BENEFITS COULD BE DERIVED FROM INCREASED USE OF THE ESTUARY ONCE ITS WATER QUALITY WAS IMPROVED. (W70-01766).

00182. ELECTROSORPTION AND DESORPTION PROCESS FOR DEMINERALIZATION.

LACEY, R.E.

OFFICE OF SALINE WATER RES AND DEVELOP PROGR REP NO 398, 1969. 117 P.

AN IMROVED DESIGN FOR ELECTROSORPTION STACKS, AND METHODS OF MAKING ACCEPTABLE ELCTROSORPTION MEMBRANES HAVE BEEN DEVELOPED. OPERATING CHARACTERISTICS OF THE IMPROVED ELECTROSORPTION STACK WERE DETERMINED IN LABORATORY EXPERIMENTS AND THEN THE STACK WAS USED IN THE FIELD TO DEMINERALIZE TWO TYPES OF NATURAL BRACKISH WATERS. THE FIELD EVALUATION UNIT WAS OPERATED 24 HOURS A DAY FOR PERIODS UP TO 54 DAYS TO DETERMINE THE BEST OPERATING CONDITIONS TO BE USED WITH THESE NATURAL WATERS. ELECTRODIALYSIS EXPERIMENTS WERE CONDUCTED WITH THE SAME WATERS. THE DATA FROM THE LONG-TERM EVALUATIONS OF DEMINERALIZATION PERFORMANCE WERE USED FOR ESTIMATING THE COST OF DEMINERALIZING THESE TWO WATERS BY ELECTROSORPTION AND BY ELECTRODIALYSIS. THE COST ESTIMATES INDICATED THE COST OF DEMINERALIZATION BY ELCTROSORPTION WOULD BE LOWER THAN THAT FOR DEMINERALIZATION BY ELECTRODIALYSIS BY ABOUT 17% FOR ONE OF THE WATERS AND ABOUT 6% FOR THE OTHER. (GPO $1.25) (W70-01671).

00183. REPLY TO COMMENTS ON 'RECREATION BENEFITS FROM WATER POLLUTION CONTROL'.

STEVENS, J.B.

WATER RESOURCES RESEARCH, 5(4), P 908-909, 1969.

STEVENS IN THIS REPLY CONCEDED THAT HIS ATTEMPT TO SEPARATE SUPPLY AND DEMAND FUNCTIONS FOR ANGLERS IN HIS FISHERY CASE WAS UNSUCCESSFUL. HAVING MADE CERTAIN AMENDMENTS HE SUGGESTS THAT THE DIFFERENCE BETWEEN HIS ARGUMENT AND BURT'S IS NOT GREAT. AS TO THE MATTER OF GROSS OR NET MEASURES OF SOCIAL VALUE, STEVENS CLAIMS THAT IT ALL DEPENDS ON WHEN ONE DEDUCTS THE COSTS OF POLLUTION CONTROL. STEVENS IS IN BASIC AGREEMENT WITH BURT'S SUGGESTION THAT PRODUCERS' SURPLUS AS WELLAS CONSUMERS' SURPLUS BE CONSIDERED IN DETERMINING NET SOCIAL VALUE OF RECREATION RESOURCES. HE SUGGESTS THAT THE LITERATURE IN THE AREA IS IN NEED OF AN EXPANDED FORM OF THE MODEL WHICH BURT PRESENTS. AS AN INDUCEMENT FOR BURT TO EXPAND HIS MODEL, STEVENS POSES THREE PROBLEMS FOR CONSIDERATION. THE FIRST IS THE MEANING OF PRODUCERS' SURPLUS WHEN GOVERNMENT, RATHER THAN PROFIT SEEKERS, PRODUCES THE SERVICE. SECONDLY, HOW IS OPTIMUM PRICING DEFINED WHEN THE COST RELATIONSHIP IN ITS MARGINAL FORM IS DECLINING AND APPROACHES THE QUANTITY AXIS ASYMPTOTICALLY. THIRD, UNDER WHAT CONDITIONS WOULD CONSUMERS' PLUS PRODUCERS' SURPLUS OVERESTIMATE THE VALUE OF RECREATION RESOURCES RELATIVE TO COMPETING USES WHERE MARKET PRICES ARE MORE READILY OBTAINABLE. THE AUTHOR, AS AN ADDENDUM, POINTS OUT AN ERROR IN HIS ORIGINAL ARTICLE IN HIS ESTIMATES OF INCOME ELASTICITIES. (W70-01373).

COST ANALYSIS OF WATER POLLUTION CONTROL

00184. SOIL SEALING CHEMICALS AND TECHNIQUES.

MANNION, J.J.; PORTER, D.J.
OFFICE SALINE WATER RES AND DEVELOP PROGR REP NO 381, 1968. 31 P.

MATERIALS TO BE USED IN MAKING SOILS IMPERMEABLE TO CONCENTRATED BRINE FOR DISPOSAL BY EVAPORATION WERE STUDIED. ROSWELL SOIL FROM NEW MEXICO WAS RENDERED IMPERVIOUS BY FOUR CLASSES OF ADDITIVES, NAMELY, LIGNIN DERIVATES GELLED WITH SODIUM CHROMATE OR ALUM, CARBOXMETHYL CELLULOSE WITH ALUM, PETROLEUM EMULSIONS, AND AN ATTAPULGITE CLAY. SOIL PERMEABILITY WAS SENSITIVE TO MOISTURE CONTENT. THIS RELATIONSHIP SHOULD BE CONSIDERED IN RESEARCH EXPERIMENTS WITH ADDITIVES AND IN FIELD INSTALLATION PROCEDURES. THE REPRODUCIBILITY OF RESULTS IN SMALL PERMEAMETERS WAS NOT AS GOOD AS EXPECTED BECAUSE OF INSUFFICIENT CONTROL OF MOISTURE LEVELS. PERMEABILITY TESTS OF LONGER DURATION NEED TO BE MADE BEFORE ANY MAJOR INSTALLATION IS CONTEMPLATED. A GRAPHICAL TECHNIQUES FOR COMPARING TREATMENT COSTS AND EFFECTIVENESS IS SUGGESTED. THE ADDITIVES COST FOR REDUCING THE SEEPAGE AT ROSWELL TO LESS THAN 6 INCHES PER YEAR AT A BRINE DEPTH OF 20 FEET BY TREATING A 6-INCH SOIL LAYER CAN BE LPW AS $500 PER ACRE. A GRAPHICAL TECHNIQUE FOR COMPARING TREATMENT COSTS AND EFFECTIVENESS IS SUGGESTED. (GPO $0.40) (W70-01273).

00185. STORM DRAINAGE ASPECTS OF THE DEEP TUNNEL PLAN.

BAUER, W.J.
PROC AISI SEMINAR, ILL INST TECHNOL, OCT 8, 1968. 29 P.

THE PROPOSED CHICAGO DEEP TUNNEL PLAN WOULD PROVIDE TEMPORARY STORAGE OF STORM RUNOFF FROM COMBINED SEWERS TO ALLOW STEADY LOW-VOLUME TREATMENT AND PREVENT DISCHARGE OF RAW SEWAGE TO SURFACE WATERS. THE TOTAL COST IS ESTIMATED TO BE 242-446 MILLION DOLLARS. OPERATING COSTS ARE EXPECTED TO BE VERY LOW BECAUSE THE FACILITY WILL BE LARGE ENOUGH TO USE PROFITABLY AS A PEAK-DEMAND PUMPED STORAGE HYDROELECTRIC PLANT. STORM RUNOFF WILL BE ONLY A SMALL PART OF THE TOTAL MOVEMENT OF WATER. THE DESIGN AND COST ANALYSIS OF THE PROJECT ARE DESCRIBED BRIEFLY. (W69-09690).

00186. ALTERNATIVES IN WATER SUPPLY.

OKUN, D.A.
JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 61(5), 215-221, 1969.

AFTER REVIEWING UNMET PHS STANDARDS AND CONFRONTING THE POSSIBILITIES OF DISEASE CAUSED BY PUBLIC WATER, THE AUTHOR DISCUSSES THREE ASPECTS OF PUBLIC WATER SUPPLIES: VIRUSES IN WATER, CHEMICALS IN WATER, AND ESTHESTIC QUALITY. THE DANGERS OF VIRUSES AND CHEMICALS MAY BE MORE FAR-REACHING THAN THEY APPEAR. ESTHETIC QUALITY IS SO LOW THAT A DISSATISFIED PUBLIC IS TURNING MORE AND MORE TO BOTTLED WATER. THE RECOMMENDED ACTION IS TO ESTABLISH A DUAL WATER SUPPLY. DRINKING WATER WOULD BE OF HIGHEST QUALITY, TAKEN FROM NATURALLY PURE SOURCES OR PRODUCED FROM BRACKISH OR SEAWATER. THE SECOND SUPPLY MIGHT BE OF QUESTIONABLE QUALITY AND ESTHETICALLY LESS DESIRABLE, BUT IT WOULD BE BACTERIOLOGICALLY SAFE THROUGH CONVENIONAL TREATMENT THAT INCLUDED DISENFECTION. IMPLEMENTATION COULD BE ACHIEVED BY PUBLIC EDUCATION OR BY A DISCRIMINATING PRICING POLICY. COSTS OF DUAL SUPPLIES WOULD NOT DIFFER SIGNIFICANTLY FROM CONVENTIONAL SYSTEMS. FUTURE TRENDS ARE DISCUSSED, INCLUDING: UTILITY TUNNELS; AUTOMATION; REGIONALIZATION OF PUBLIC WATER MAANGEMENT; NEW WATER SOURCES AVAILABLE THROUGH TECHNOLOGY, AND GREATER UTILIZATION OF HUMAN RESOURCES. THE ARTICLE IS FOLLOWED BY TWO DISCUSSIONS OF THE ARTICLE: ONE BY SAMUEL S. BAXTER, ONE BY HENRY J. GRAESER AND ALBERT H. HALFF. (W69-09566).

00187. ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS.

COFFEY, P.J. ORTOLANO, L.
JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 61(5), 237-241, 1969.

THE ARTICLE FOCUSES ON DETERMINING THE DEGREE OF WATER QUALITY ENHANCEMENT THAT SHOULD BE PROVIDED WHERE SALINITY IS THE MAJOR QUALITY INDICATOR. BENFITS ARE PERCEIVED AS COSTS AVOIDED BY DOWNSTREAM USERS DUE TO SALINITY REDUCTION. THE PURPOSE OF THIS ARTICLE IS TO SUGGEST A DESIGN FOR AN ECONOMICALLY EFFICIENT CONTROL PROGRAM. ANALYSIS IS LIMITED TO THE CASE WHERE LOAD AND LEVEL OF WATER ARE CONSTANT. AN ANALOGY IS MADE BETWEEN THIS METHOD AND THE TECHNIQUES USED IN PLANNING FLOOD PROTECTION. SECTION I DISCUSSES SPECIAL PROBLEMS IN MINERAL POLLUTION CONTROL. SECTION II DESCRIBES THE PROPOSED METHOD FOR RELATING COSTS OF SALINITY CONTROL TO WATER QUALITY. THE METHOD FULFILLS THE ECONOMIC CRITERIA ESTABLISHED BY THE PRESIDENT'S WATER RESOURCES COUNCIL IN 1962: (1) TOTAL TANGIBLE BENEFITS EXCEEDING COSTS; (2) MARGINAL BENEFITS OF EACH SEPARABLE UNIT OF A PROJECT EXCEEDING ITS COST; AND (3) SCOPE OF DEVELOPMENT SUFFICIENT TO MAXIMIZE NET BENEFITS. SECTION III APPLIES THE METHOD. SECTION IV DISCUSSES THE VALUE AND LIMITATIONS OF THE METHOD. IT SHOULD BE USEFUL IN DEVELOPING A PROGRAM TO RELIEVE A CURRENT CONDITION OF SALINE POLLUTION. IT WILL NOT GIVE ANSWERS FOR SITUATIONS THAT INVOLVE A DEVELOPING BASIN ECONOMY. (W69-09565).

00188. HYPERBOLIC COOLING TOWERS WITH RESERVOIR STORAGE OF MAKEUP TO SERVE THE PROPOSED KEYSTONE GENERATING STATION.

SMITH, A.F., BOVIER, R.E.
PROCEEDINGS OF THE AMERICAN POWER CONFERENCE, VOL 25, P 406-415, 1963.

THIS ARTICLE DESCRIBES THE STUDIES WHICH LED TO THE SITE SELECTION OF KEYSTONE GENERATING STATIONS, INDICATING THAT LARGE PLANTS CAN BE LOCATED ON SMALL STREAMS, AND PROPOSES COOLING ARRANGEMENTS WHICH OVERCOME SPECIFIC DIFFICULTIES AT A LOCATION. THE EFFECT OF DISCHARGES ON STREAM FLOW DURING NORMAL AND CRITICAL YEARS IS SHOWN. COAL RESOURCES AND COST STUDIES AND A PLANT SITE SURVEY WERE CONDUCTED. HYPERBOLIC COOLING TOWERS WERE CHOSEN BECAUSE THEY WERE ECONOMICAL FOR LARGE UNIT INSTALLATIONS WITH HIGH LOAD FACTORS, THEY REQUIRED LESS SPACE THAN OTHER UNITS, AND THIER STACK HEIGHTS (APPROXIMATELY 300 FT) MINIMIZED FOG AND AIR POLLUTION PROBLEMS. THE TOWER'S HEAT LOAD CAN BE INCREASED BY INCREASING EITHER THE WATER FLOW OR THE COOLING RANGE. THE OPTIMUM COOLING RANGE WAS EVALUATED AT 25 DEG TO 30 DEG F. A MAKEUP

RESERVOIR IS MOST ADVANTAGEOUS BECAUSE OF ITS MOBILITY. A COST COMPARISON WITH ANOTHER RIVER SITE CONCLUDED THAT THE NORMAL ECONOMIC PENALTIES OF A COOLING TOWER PLANT WERE NOT SERIOUS IF THE ADVANTAGES OF A CLOSED-LOOP COOLING TOWER ARRANGEMENT WERE RECOGNIZED. (W69-09318).

00189. DISPOSAL OF BRINE EFFLUENTS FROM INLAND DESALTING PLANTS: REVIEW AND BIBLIOGRAPHY.

DEPUY, G.W.
OFFICE OF SALINE WATER, RESEARCH AND DEVELOPMENT PROGRESS REPORT NO 454. JULY1969. 211 P.

THE BUREAU OF RECLAMATION HAS BEEN AUTHORIZED BY THE OFFICE OF SALINE WATER TO CONDUCT AN 8-PART PROGRM ON SURFACE FACILITIES FOR DISPOSAL OF DESALTING PLANT EFFLUENTS. THE PROGRAM CONSISTS OF: (1) PREPARING A STATE-OF-THE-ART BIBLIOGRAPHY AND A REVIEW, (2) TEST SOIL SAMPLES FROM A PROPOSED BRINE EVAPORATION POND SITE, (3) LABORATORY TESTS ON POND LINING MATERIALS AND SOIL SEALANTS, (4) DEVELOP A MONITORING SYSTEM FOR SEEPAGE LOSS MEASUREMENTS, (5) DEVELOP TECHNIQUES FOR INCREASING EVAPORATION RATES, (6) CONDUCT FIELD TESTS OF POND LININGS AND DEVLOP OPTIMUM APPLICATION METHODS, (7) PREPARE A MANUAL ON SURFACE FACILITIES FOR DISPOSAL OF DESALTING PLANT EFFLUENTS, AND (8) CONDUCT AN ECONOMIC STUDY OF SALT DISPOSAL. THIS REVIEW AND BIBLIOGRAPHY WAS PREPARED AS PART I OF THE BUREAU'S PROGRAM. THE TECHNICAL LITERATURE WAS REVIEWED FOR INFORMATION ON ALL PARTS OF THE BUREAU'S PROGRAM. A SURVEY OF 50 STATES AND THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION ON WATER POLLUTION REGULATIONS PERTAINING TO SURFACE FACILITIES FOR DISPOSL OF DESALTING PLANT EFFLUENTS IS APPENDED TO THE REVIEW. THE BIBLIOGRAPHY CONTAINS 870 REFERENCES. REFERENCES ARE INDEXED AND CROSS REFERENCED ACCORDING TO 18 SUBJECT AREAS. (W69-09353).

00190. SYSTEMS ANALYSIS OF THE ASSIMILATIVE CAPACITY OF STREAMS.

THOMAN, R.V.
PROC SECOND ANNU WATER QUALITY RES SYMP, ALBANY, NY, P 31-47, APRIL 1965.

THE BASIC CONCEPTS OF SYSTEMS ANALYSIS AND THEIR APPLICATION FOR SOLVING WATER POLLUTION CONTROL PROBLEMS WERE PRESENTED. A MATHEMATICAL MODEL WAS DEVELOPED TO SOLVE WATER QUALITY PROBLEMS OF THE DELAWARE ESTUARY USING LINEAR PROGRAMMING TECHNIQUES. THE GOAL OF THE STUDY WAS TO DEVELOP TECHNIQUES FOR MINIMIZING THE OVERALL COST OF IMPROVING WATER QUALITY IN A SITUATION WHERE THERE WERE MANY WASTE SOURCES ALL CONTRIBUTING IN VARIOUS DEGREES TO THE OXYGEN DEMAND. IT WAS SHOWN THAT THE TECHNIQUES EMPLOYED WERE USEFUL IN PLACING VARIOUS WATER POLLUTION PROBLEMS (INCLUDING THE CLASSICAL OXYGEN DEMAND SAG IN AN ANALYTICAL INPUT-OUTPUT FRAMEWORK WHICH COULD THEN BE FURTHER UTILIZED IN THE FORMULATION OF OPTIMUM WATER POLLUTION CONTROL POLICIES. IT WAS ALSO SHOWN THAT A VARIETY OF ADDITIONAL WASTE REMOVALS WAS NECESSARY AT EACH OF THE SEVEN WASTE SOURCES, THAT THE DELAWARE ESTUARY HAD MANY LEVELS OF WASTE ASSIMILATIVE CAPACITY AND THAT THERE WERE OBVIOUS PROBLEMS ASSOCIATED WITH THE LEAST COST SOLUTION. (W69-09374).

00191. IMPORT ALTERNATIVES.

YOUNG, G.
ARID LANDS IN PERSPECTIVE, P 382-397, UNIVERSITY OF ARIZONA PRESS, TUCSON, 1969.

THIS PAPER REVIEWS SOME WATER MANAGEMENT ALTERNATIVES TO LARGE-SCALE TRANSFER OF WATER. DATA ON THE WORLD WATER CYCLE AND ON AVERAGE RIVER FLOWS OF SOME OF THE IMPORTANT RIVERS OF THE WORLD ARE PRESENTED. ARID AREAS ARE TREATED IN HISTORICAL PERSPECTIVE, AND THEIR LAND AREA IS COMPARED TO THAT OF AGRICULTURAL AREAS. THE WATER DEVELOPMENT POTENTIAL OF THE GANGES VALLEY IS POINTED OUT. UTILIZATION OF RIVERS TO CARRY GARBAGE AND WASTE TO THE SEA IS RELATED TO WATER POLLUTION AND WATER SHORTAGE PROBLEMS. DIAGRAMS, FORMULI AND WATER COSTS FOR LARGE CITY WATER SYSTEMS WITH RECYCLING OF WATER ARE PRESENTED. SEVERAL TYPES OF DESALINATION ARE DISCUSSED AND COSTS ARE COMPUTED FOR THESE AND VARIOUS COMBINED TREATMENT-DESALINATION SYSTEMS FOR LARGE CITIES. PROBLEMS OF EFFICIENT USE OF DESALINATED WATER IN SEASHORE AGRICULTURE ARE CONSIDERED. METHODS ARE DISCUSSED OF INCREASING PRECIPITATION BY SEEDING CLOUDS AND 'CATCHING' FOG, AND OF INCREASING RUNOFF BY ALTERATION OF THE VEGETATION. (W69-09220).

00192. ELECTRIC UTILITIES INCLUDE BUILT-IN SAFEGUARDS FOR ENVIRONMENTAL PROTECTION.

ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 3(6), 523-525, 1969.

THE DESIGN, COST, AND EFFICIENCY OF POLLUTION CONTROL FACILITIES IN THE BUILDING OF ELECTRIC POWER PLANTS IS DISCUSSED IN THREE SECTIONS: WATER, AIR, THERMAL ASPECTS. THE THREE STATIONS CONCERNED ARE MINE-MOUTH PLANTS IN PENNSYLVANIA, KEYSTONE (TWO 900 MW UNITS), HOMER CITY (TWO 640 UNITS), CONEMAUGH (TWO 900 MW UNITS). WATER DEMAND IS REDUCED IN THE NEW PLANTS BY COOLING TOWERS, RECIRCULATING SYSTEMS AND STORAGE RESERVOIRS USED TO AUGMENT LOW FLOW STREAMS IN THE SUMMER AND ALSO AS A NEUTRALIZER. NEW PROTECTION DEVICES (OIL SKIMMERS, DIVERSIONARY DAMS AND DITCHES, AND MANHOLE APPURTENANCES) WERE USED TO KEEP OIL SPILLAGE FROM CONTAMINATING THE STREAM. ELECTRICAL PRECIPITATORS (95% EFFICIENCY) WERE USED TO CONTROL FLY ASH AND HIGH STACKS WERE DESIGNED TO AVOID GROUND LEVEL CONCENTRATION OF SO2. AIR QUALITY LEVELS ARE BEING TESTED AT ALL THREE PLANTS. LARGE ELECTRIC STATIONS CAN BE LOCATED ON SMALL STREAMS WITHOUT POLLUTION HAZARDS IF DESIGNED WITH WATER STORAGE AND HYPERBOLIC NATURAL DRAFT TYPES. LARGE COOLING WATERS ARE THE MOST ECONOMICAL OF ALL SYSTEMS. (W69-09302).

00193. THE DELAWARE ESTUARY STUDY.

KNEESE, A.V.; BOWER, B.T.
MANAGING WATER QUALITY: ECONOMICS, TECHNOLOGY, INSTITUTIONS, PP 224-235, THE JOHNS HOPKINS PRESS, BALTIMORE, 1968.

A LINEAR PROGRAMMING ECONOMIC OPTIMIZATION MODEL WAS COMBINED WITH A PHYSICAL (OXYGEN SAG) MODEL OF THE DELAWARE ESTUARY TO PERMIT COMPARISON OF ALTERNATIVE DOSE OF WATER QUALITY CONTROL WITH THE LEAST-COST SOLUTION. FIVE 'OBJECTIVE SETS' WERE INVESTIGATED, RANGING FROM MAINTENANCE OF 1964 QUALITY CONDITIONS, UP TO CONSIDERABLE IMPROVEMENT IN QUALITY RESULTING IN IN-

CREASED WATER CONTACT RECREATION. THE SUMMARIZED RESULTS OF THE STUDY, FOR UNIFORM TREATMENT, ZONED TREATMENT AND LEAST-COST TREATMENT WERE TABLED AND DISCUSSED. BENEFITS WHICH WOULD RESULT FROM THE VARIOUS OBJECTIVE LEVELS WERE DESCRIBED AND TABLED. OTHER METHODS FOR STREAM IMPROVMENT, SUCH AS REGIONAL COLLECTION, OCEAN DISPOSAL AND MECHANICAL REOXYGENATION WERE BRIEFLY DISCUSSED. (W69-05728).

00194. CHICAGOLAND DEEP TUNNEL SYSTEM FOR POLLUTION AND FLOOD CONTROL: FIRST CONSTRUCTION ZONE, DEFINITE PROJECT REPORT.

WORK PERFORMED FOR METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO. HARZA ENGINEERING CO AND BAUER ENGINEERING, INC, CHICAGO, ILL, MAY 1968. 199 P.

THE DEEP TUNNEL SYSTEM IS A MULTIPURPOSE PROJECT TO CAPTURE POLLUTED STORM OVERFLOWS, TREAT THEM, AND GRADUALLY RETURN THEM TO THE WATERWAYS. THE SYSTEM, WHEN NOT IN USE, PUMPS WATER TO GENERATE POWER. CHAPTER ONE BRIEFLY DESCRIBES THE PROGRAM FOR THE ENTIRE CHICAGO AREA. SELECTION OF THE CALUMET AREA AS THE FIRST CONSTRUCTION ZONE IS JUSTIFIED. THE INVESTIGATIONS PROGRAM FOR THE ZONE IS DESCRIBED. CHAPTER TWO GIVES THE GENERAL CONCEPT OF THE PLAN, SUMMARILY DESCRIBES PROJECT FEATURES, AND DISCUSSES OPERATION OF THE ENTIRE SYSTEM. CHAPTER THREE DISCUSSES EXISTING WATERFLOWS. IT EXAMINES THE SERVICE AREA, WATERWAYS, THE EXISTING COMBINED SEWER SYSTEMS, FLOODING PROBLEMS, HYDOLOGICAL APSECTS OF COMBINED SEWER OVERFLOWS, AND QUALITY OF OVERFLOWS. CHAPTERS FOUR THROUGH EIGHT DISCUSS PROJECT FEATURES AT LENGTH, CHAPTER FOUR COVERING THE INTERCEPTION AND CONVEYANCE STRUCTURES, FIVE, THE MINED STORAGE RESERVOIR, SIX, THE PUMPING-GENERATING STATION, SEVEN, THE SURFACE RESERVOIR AND REGULATING FACILITIES; AND, EIGHT, WATER TREATMENT FACILITIES AND PROCESSES. CHAPTER NINE DISCUSSES OVERALL SYSTEM OPERATION. CHAPTER TEN DEFINES ALTERNATIVES AND PROVISIONS FOR EXPANSION. CHAPTER ELEVEN OUTLINES PROJECT IMPLEMENTATION AND COST ESTIMATES. THE LAST TWO CHAPTERS SUMMARIZE AND JUSTIFY THE PROJECT, AND DISCUSS ITS FINANCING. (W69-05743).

00195. NUTRIENT REMOVAL FROM SECONDARY EFFLUENT BY ALUM FLOCCULATION AND LIME PRECIPITATION.

MALHOTRA, S.K.; LEE, G.F.; ROHLICH, G.A.
INT J AIR WAT POLL, VOL 8 PP 487-500, 1964.

CONDITIONS WERE STUDIED FOR REMOVAL OF PHOSPHORUS AND NITROGEN COMPOUNDS FROM BIOCHEMICALLY TREATED WASTEWATER EFFLUENTS BY ALUM FLOCCULATION AND LIME PRECIPITATION. THEY FLOCCULATED OR PRECIPITATED SAMPLES OF SECONDARY EFFLUENT ACCORDING TO CONVENTIONAL JAR TEST PROCEDURES. PHOSPHORUS REMOVAL WAS HIGHLY PH DEPENDENT WITH AN OPTIMUM PH OF 5.57 PLUS-OR-MINUS 0.25. AT THIS PH, AN ALUM DOSE OF 250 MILLIGRAMS/LITER REMOVED 95% OF TOTAL PHOSPHORUS, 55% OF THE CHEMICAL OXYGEN DEMAND, 60% OF THE ORGANIC NITROGEN, 25% OF THE NITRATE-NITROGEN AND NITRITE-NITROGEN, 17% OF THE APPARENT ALKYLBENZENE SULFONATE, AND NONE OF THE AMMONIA-NITROGEN. A DOSE OF 600 MILLIGRAMS/LITER OF CALCIUM HYDOXIDE RAISED PH SAMPLE TO 11 AND REMOVED 99% OF TOTAL PHOSPORUS. ESTIMATED CHEMICAL COSTS FOR REMOVAL OF 95% OF TOTAL PHOSPHORUS BY LIME AND ALUM WERE 32 AND 73 DOLLARS PER MILLION GALLONS, RESPECTIVELY. (W69-05865).

00196. ARTIFICIAL DESTRATIFICATION IN RESERVOIRS OF THE CALIFORNIA STATE WATER PROJECT.

TEERINK, J.R.; MARTIN, C.
J AMER WATER WORKS ASS, 61(9), 436-440, 1969.

DESTRATIFICATION AND AERATION IN CALIFORNIA RESERVOIRS ARE ACCOMLISHED AY AIR INJECTION AND MULTIPLE LEVEL OUTLET STRUCTURES. MIXING RETURNS NUTRIENTS TO THE PHOTOSYNTHETIC ZONE FOR USE BY ORGANISMS, AND OXIDIZES IRON AND MANGANESE. THE EFFECTS MAY BE BENEFICIAL OR DETRIMENTAL TO INTENDED WATER USES. EVAPORATION IS USUALLY REDUCED BECAUSE SURFACE WATER TEMPERATURES ARE LOWERED. DISSOLVED OXYGEN IS INCREASED. BECAUSE ARTIFICIAL DESTRATIFICATION CAN PRODUCE BOTH BENEFITS AND DETRIMENTS, A STUDY SHOULD BE MADE OF PRIORITY OF USES AND THE EFFECTS OF MIXING, AND COST-BENEFIT ANALYSES SHOULD BE MADE, PLACING A VALUE ON THE VARIOUS QUALITY CHANGES RELATED TO MIXING. (W69-09883).

00197. COMMENT ON ECONOMY OF WATER QUALITY MANAGEMENT AND POLLUTION CONTROL. (REMARKS BY WOOD).

WOOD, J.E. III.
IN THE FRESH WATER OF NEW YORK STATE: ITS CONSERVATION AND USE, P 62-64, WM C BROWN BOOK CO, DUBUQUE, IOWA 1967.

THE AUTHOR AGREES WITH THE PAPER BEING COMMENTED ON IN RESPECT TO THE IMMENSITY OF THE WATER POLLUTION PROBLEM, BOTH PRESENT AND FUTURE AND THAT, ASIDE FROM ALL AESTHIC CONSIDERATION, THERE ARE COMPELLING ECONOMIC JUSTIFICATIONS FOR WATER POLLUTION CONTROL AND ABATEMENT. HOWEVER, THE AUTHOR QUESTIONS THE PROPRIETY OF THE PROPOSED SYSTEM OF 'EFFLUENT CHARGES' TO BE IMPOSED BY THE GOVERNMENT AND PAID TO GOVERNMENTS BY POLLUTERS. THE PRINCIPAL ARGUMENT AGAINST SUCH CHARGES IS THAT IF THE CHARGE IS SUFFICIENTLY MODEST TO BE INTOLERABLE, IT BECOMES A PURCHASED LICENSE TO POLLUTE. ON THE OTHER HAND, IF IT IS SET HIGH ENOUGH TO EFFECTIVELY PREVENT POLLUTION, IT BECOMES PUNITIVE IN NATURE AND A POOR SUBSTITUTE FOR DIRECT REGULATION. IT IS ALSO ARGUED THAT THE COMPLEXITY OF ADMINISTRATION OF A SYSTEM OF EFFLUENT CHARGES IS TOO GREAT TO BE PRACTICAL. (W69-099[illegible]).

00198. OPTIMIZATION MODELS FOR RIVER BASIN WATER QUALITY MANANGEMENT AND WASTE TREATMENT PLANT DESIGN.

SHIH, O.S.; DEFILIPPI, J.A.
PROC, FOURTH AMER WATER RESOURCE CONF, N Y, P 754-779, NOV 1968.

MATHEMATICAL MODELS WHICH DESCRIBED THE INTERDEPENDENCY OF SYSTEMS COMPONENTS WERE USED TO OPTIMIZE THE OVERALL ECONOMIC RETURN FROM WATER QUALITY MANAGEMENT IN A RIVER BASIN. THE OBJECTIVE OF THE STUDY WAS TO PRESENT AN OPTIMIZATION MODEL WHICH CONSIDERED THE TOTAL COST TO WATER USERS AND WASTE DISCHARGERS IN A BASIN, AND TO IDENTIFY DIRECT BENEFITS IN TERMS OF REDUCED TREATMENT COSTS. TWO DYNAMIC PROGRAMMING MODELS WERE PRESENTED. THE FIRST WAS A

WATER QUALITY MANAGEMENT MODEL THAT MINIMIZED THE TOTAL COSTS OF BOTH WATER AND WASTE TREATMENT IN THE RIVER BASIN. THE SECOND MODEL DESIGNED FOR OPTIMUM WASTE TREATMENT PLANT DESIGN COULD ADD AN EXTRA COST-SAVING REFINEMENT TO THE FIRST MODEL. IT WAS FELT THAT BETTER WATER QUALITY MANAGEMENT COULD BE ACHIEVED BY USING FIRST MODEL. THE WASTE TREATMENT PLANT DESIGN MODEL COULD ALSO BE APPLIED INDEPENDENTLY FOR NORMAL INDUSTRIAL AND MUNCIPAL WASTE TREATMENT DESIGN PROBLEMS. (W69-10021).

00199. RESEARCH AND DEVELOPMENT FOR REUSE OF WATER.

MCCARTY, P. L.
IN WATER: DEVELOPMENT, UTILIZATION, CONSTRUCTION, 5TH WESTERN RESOURCES CONFERENCE, BOULDER, COLO, 1963. P 55-59.

WITH AN ANTICIPATED DEMAND OF NEARLY 600 BILLION GALLONS PER DAY BY 1980, IT'S EXPECTED THAT AT LEAST FIVE OF THE NATION'S WATER RESOURCE AREAS WILL EXPERIENCE A WATER SHORTAGE. THE REUSE OF WATER IS SEEN AS THE ANSWER TO AMELIORATING THIS PROBLEM. WHILE THE METHOD OF INCREASING THE COST OF WATER COULD ALTER WATER USE HABITS AND IMPROVE THE SHORTAGES, EFFECTIVE REUSE IS RECOMMENDED AS THE MORE DESIRABLE METHOD OF SOLVING THE PROBLEM. THREE CONCLUSIONS REACHED: (1) IMPROVED METHODS OF WASTE TREATMENT USING NEW CHEMICAL, PHYSICAL OR BIOLOGICAL METHODS MUST BE DEVISED, WITH A CONCENTRATION OF RESEARCH EFFORTS AIMED AT DEVELOPING THESE METHODS, (2) WATER QUALITY STANDARDS SHOULD BE COMPATIBLE WITH HEALTH STANDARDS BUT NOT SO RESTRICTIVE AS TO LIMIT THE AMOUNT OF REUSE OF WATER, AND (3) THE ROLE OF WATER RESOURCE PERSONNEL IS SEEN AS ENGAGING IN EFFECTIVE COMMUNICATION BETWEEN RESEARCHERS, WATER MANAGERS AND PUBLIC OFFICIALS, AND IN ATTRACTING HIGH-QUALITY PEOPLE INTO THE FIELD OF WATER RESOURCE DEVELOPMENT. (W69-10198).

00200. CHEMICAL PURIFICATION OF VARIOUS INDUSTRIAL WASTE WATERS (IN GERMAN).

BALLNUS, W.
WASSER LUFT BETR., VOL 8, P 201-204, 1964.

PPTN. PROCESSES ARE DESCRIBED FOR THE TREATMENT OF WASTE WATER FROM A PAPERAND CERAMIC-PRODUCING INDUSTRY AND A TEXTILE PLANT. GOOD PURIFICATION WAS OBTAINED IN THE FIRST CASE WITH A12(SO4) 3 AND ACTIVATED SIO 2. USABLE RESULTS WERE OBTANED WITH FESO4 IN COMBINATION WITH CA(OH) 2 AND WITH A12(SO4) 3 IN THE TREATMENTOF TEXTILE WASTE WATER. A SO-CALLED 'WASTE WATER PURIFICATION SULFATE' GAVE THE SAME RESULTS AS A12(SO4) 3 BUT THE USEFULNESS OF THIS PRODUCT HAS NOT BEEN COMPLETELY TESTED. COSTS OF CHEMICALS FOR THE INDIVIDUAL PPTN. PROCESSES ARE GIVEN. (W69-10280).

00201. SPRAY IRRIGATION FOR THE REMOVAL OF NUTRIENTS IN SEWAGE TREATMENT PLANT EFFLUENT AS PRACTICED AT DETROIT LAKE, MINNESOTA.

LARSON, W.C.
PUB SEC TR W61-3. ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO. TRANS OF SEMINAR ON ALGAE AND METROPOLITAN WASTES, PP 125-129. APRIL 27-29, 1960.

THE HISTORY OF SEWAGE TREATMENT AND DISPOSAL, BY A RESORT TOWN IN AN AREA OF RECREATIONAL LAKES IN MINNESOTA, IS DESCRIBED. INVESTIGATION OF METHODS OF NUTRIENT REMOVAL RESULTED FROM A LAWSUIT BROUGHT AGAINST THE CITY PROPERTY OWNERS ON A DOWNSTREAM LAKE IN WHICH INCREASING ALGAL BLOOMS WERE BECOMING A NUISANCE. MINNESOTA DEPARTMENT OF HEALTH MADE RECOMMENDATIONS FOR A STUDY PROGRAM OF THE PROBLEM. CONSIDERATION WAS GIVEN TO THE EXPERIMENTAL ALUM COAGULATION METHOD, STUDIED AT THE UNIVERSITY OF WISCONSIN, AND LIME COAGULATION EXPERIMENTS AT DETROIT LAKES, BY THE MINNESOTA DEPARTMENT OF HEALTH. PONDING OF EFFLUENT WAS ALSO CONSIDERED, BUT IRRIGATION WAS THE METHOD FINALLY SELECTED. SITE INVESTIGATION WAS CARRIED OUT TO DETERMINE SOIL PERMEABILITY, EFFECTS OF VEGETATION, PROBILITY OF ODORS, OPERATING CONDITIONS IN WINTER, AND EFFECTS ON GROUND WATER. COST OF INITIAL INSTALLATION (1955) TO HANDLE 600 GPM WAS $6,500. EFFECT ON GROUND WATER WAS DETERMINED BY BEFORE AND AFTER SAMPLES FROM A TEST WELL WHICH SHOWED A THREE FEET, ONE INCH RISE IN WATER LEVEL IN FOUR YEARS; TOTAL INCREASES IN PPM: PHOSPHORUS, 0.96 TO 2.9F NITROGEN, 2.6 TO 33.2; HARDNESS, 300 TO 420. OPERATING COSTS OF THE INSTALLATION ARE ESSENTIALLY THAT OF POWER REQUIREMENTS. (W69-7820).

00202. METHODS FOR THE STUDY OF HYDROGEOLOGICAL PARAMETERS OF UNDERGROUND STORAGE OF INDUSTRIAL WATER DISCHARGES (RUSSIAN).

GOLDBER, V.M.; SEMENOVA, S.M.; CHAPOVSKITY, YE.G.; SHESTAKOV, V.M.
RAZVED I OKHRANA, NO 3, PP 41-46, MAR 1969.

AFTER TRACING BRIEFLY THE DEVELOPMENT OF UNDERGROUND STORAGE TECHNIQUES OF POLLUTED WATERS IN USSR AND ABROAD (USA, FRANCE, ETC), THE AUTHORS DISCUSS THE FIELD AND LABORATORY ANALYSES OF PERTINENT CHARACTERISTICS OF RESERVOIR ROCKS AND INDUSTRIAL WATERS WHOSE PRELIMINARY KNOWLEDGE IS NECESSARY FOR EFFICIENT STORAGE OF POLLUTED WATERS. THE MAIN CHARACTERISTICS OF THE ANALYSIS ARE THE FORECASTING OF POLLUTION CIRCULATION AND THE EXTENT AND PERMEABILITY OF THE LAYERS UNDER STUDY. THE STUDY SHOWS THAT THE UTILIZATION OF NATURAL EARTH CRUST STRUCTURES FOR STORAGE OF POLLUTED WATER NECESSITATES THAT FOLLOWING PRELIMINARY STEPS: (1) DEVELOPMENT OF THE METHODS CAPABLE OF RECOGNIZING THE PRESENCE OF HOMOGENEITY CHARACTERISTICS IN WATER-BEARING FORMATIONS, ALSO THE POLLUTED WATER CIRCULATION PATTERNS, (2) THE STUDY OF HYDRODYNAMICS OF INTERACTING HORIZONS; (3) DEVELOPMENT OF ANALYTICAL BASIS FOR THE QUANITIATIVE EVALUATION OF PHYSICO-CHEMICAL INTERACTION TAKING PLACE BETWEEN THE PUMPED LIQUID AND LIQUID CONTENT OF ROCK FORMATIONS, AND (4) DEVELOPMENT OF BETTER TECHNOLOGY IN USING BOREHOLES IN EXPLORATION AND EXPLOITATION. (W69-08015).

COST ANALYSIS OF WATER POLLUTION CONTROL

00203. CONSERVATION OF WATER BY REUSE IN THE UNITED KINGDOM.

MILLER, D.G.; NEWSOME, D.H.
WATER REUSE, AMER INST CHEM ENG PROGR SYMP, 78(63), 13-31, 1967.

THE HISTORICAL BACKGROUND OF WATER SUPPLY IN THE UNITED KINGDOM AND THE INFLUENCE OF RECENT LEGISLATION ON WATER RESOURCES PLANNING AND EFFLUENT CONTROL ARE OUTLINED. GENERAL CONSIDERATION IS GIVEN TO AVAILABLE RESOURCES AND THE DEVELOPMENT OF THE PATTERN OF DEMAND. THE PRINCIPLES OF RECYCLING ARE CONSIDERED IN RELATION TO THE OVERALL EFFECTS AND THE IMPACT ON INDIVIDUAL USERS. IN PARTICULAR THE QUESTIONS OF EFFLUENT QUALITY AND DISPOSAL ARE DISCUSSED IN THE LIGHT OF PAST PRACTICES. SOME OF THE COMMONLY USED TREATMENT METHODS ARE DESCRIBED AND ARE SHOWN TO CONSIST MAINLY OF TECHNIQUES TO REMOVE SUSPENDED SOLIDS AND CERTAIN ORGANIC MATERIALS. EXAMPLES ARE GIVEN OF RECYCLING APPLICATIONS IN THE UNITED KINGDOM WHICH HAVE MAINLY ARISEN DUE TO THE SHORTAGE OF WATER IN CERTAIN AREAS. FINALLY, THE PAPER ATTEMPTS TO ASSESS THE LIKELY TRENDS AND POSSIBLE LIMITATIONS IN THE FUTURE USE OF RECYCLING TECHNIQUES. (W69-08032)

00204. CONSERVATION OF WATER BY REUSE IN ITALY.

MEUCCI, F.
WATER REUSE, AMER INST CHEM ENG PROGR SYMP, 78(63), 32-36, 1967.

WATER REUSE IN ITALY IS AFFECTED BY UNDERGROUND AVAILABILITY AND WATER RATES. THREE ITALIAN REUSE PLANTS ARE DESCRIBED: IN A SUGAR FACTORY AFTER SIMPLE SEDIMENTATION AND STERLIZATION, WASHING AND CONVEYING WATERS ARE RECIRCULATED; IN A METAL-WORKING FACTORY, ACIDIC AND ALKALINE WATERS ARE SINGLY TREATED FOR REMVOING CYANIDE AND CHROMIUM AND THEN MIXED, NEUTRALIZED, AND CLARIFIED TO BE REUSED IN A RAIN IRRIGATION SYSTEM AND IN FIRE PROTECTION; IN A STEEL PIPE MILL, ACID-WASHING WATERS AND COOLING WATERS, CONTAINING IRON SLAGS, ARE RECIRCULATED AFTER OIL REMOVAL, ADDITION OF HYDRATED LIME, AND CLARIFICATION BY FERROUS SULFATE, AND COOLING. (W69-08033).

00205. WATER REUSE IN WEST GERMAN INDUSTRY.

WOLTERS, N.
WATER REUSE, AMER INST CHEM ENG PROGR SYMP, 78(63), 41-45, 1967.

THE GREAT CONCENTRATION OF WATER-USING INDUSTRIES IN THE RUHR VALLEY, AND THE NEED TO MINIMIZE POLLUTION OF THE RIVER RHINE, HAVE FORCED MAXIMUM INTRAPLANT REUSE OF WATER. SPECIAL EFFORTS ARE MADE IN NEW PLANT DESIGN TO MAKE MORE EFFECTIVE REUSE POSSIBLE, RESULTING IN THE CASE OF ONE STEEL MILL COMPLETELY REUSING ALL INCOMING WATER. THE CREATION OF AREA WATER MANANGEMENT ASSOCIATIONS THAT CHARGE INDIVIDUAL PLANTS ON THE BASIS OF POLLUTION LOAD OF THEIR EFFLUENTS MAKES IT WORTHWHILE TO CONTINUE STUDIES FOR MORE EFFICIENT REUSE. SPECIAL PROBLEMS ASSOCIATED WITH BEET SUGAR, COAL MINING, ELECTROPLATING, AND HEAVY CHEMICALS INDUSTRIES ARE DISCUSSED. (W69-8035).

00206. THE UTILIZATION OF MUNICIPAL WASTEWATER IN JAPAN.

IDE, T.; MATSUMOTO, N.; ARIMITSU, H.
WATER REUSE, AMER INST CHEM ENG PROGR SYMP, 78(63), 46-53, 1967.

THE RAPID PROGRESS OF JAPANESE INDUSTRY HAS RESULTED IN AN INCREASING DEMAND FOR WATER. CONSEQUENTLY, GREATER EMPHASIS IS BEGINNING TO BE PLACED ON WATER CONSERVATION. AS A POTENTIAL METHOD FOR WATER CONSERVATION, SOME OF THE CITIES IN JAPAN HAVE BUILT LARGE INDUSTRIAL WATER PLANTS UTILIZING SEWAGE PLANT EFFLUENT AS THE WATER SOURCE, AND HAVE SUPPLIED A COLLOIDAL MATTER-FREE EFFLUENT TO INDUSTRIES IN THE AREA. SUSPENDED OR COLLOIDAL MATTER IS REMOVED BY COAGULATION WITH ALUMINU RETARDATION OR CHEMICAL SOFTENING CAUSED BY PHOSHATE IN SEWAGE PLANT EFFLUENT CAN BE OVERCOME BY THE USE OF FERRIC CHLORIDE AS A COAGULANT. (W69-08036).

00207. WATER REUSE IN ISRAEL.

ZOHAR, B.C.; SALITERNIK, C.
WATER REUSE, AMERICAN INSTITUTE OF CHEMICAL ENGINEERS SYMPOSIUM, 78(63), 54-65, 1967.

WATER SCARCITY IN ISRAEL HAS RESULTED IN REUSE OF 45,000 ACRE-FT/YR BY 1965, AND IN PLANNING FOR REUSE OF 110,000 ACRE-FT/YR BY 1970, INCLUDING RECLAMATION FOR POTABLE USE BY PONDING, INFILTRATION, AND DILUTION OF MUNICIPAL WASTEWATER: GREATER TEL AVIV, 80,000 ACRE-FT/YR; JERUSALEM, 5,000 ACRE-FT/YR AND OF INDUSTRIAL WASTEWATER: HADERA PAPER MILLS, 3,000 ACRE-FT/YR, AND FOR UNRESCRICTED IRRIGATION BY BIOFILTRATION, COMPLETE DISINFECTION, AND DILUTION OF GREATER HAIFA MINICIPAL WASTEWATER (7,000 ACRE-FT/YR). PROBLEMS ARE SALINITY, DISINFECTION, ION EXCHANGE BRINE, AND NITROGEN REMOVAL. SUCCESSES ARE DEVELOPMENT OF HIGHLY-LOADED PONDS AS A RELIABLE TREATMENT METHOD, AND PLANNING FOR SEASONAL UNDERGROUND STORAGE. (W69-08037).

00208. THE ROLE OF CHEMICALS IN WATER REUSE.

FORBES, M.C.; WITT, P.A. JR.,.
WATER REUSE, AMER INST CHEM ENG PROGR SYMP, 78(63), 124-129, 1967.

POLLUTION IS EXPANDING EXPONENTIALLY AND GROWS AS THE SECOND POWER OF POPULATION. THESE FACTS MAKE THE ADOPTION OF THE ZERO EFFLUENT PLANT AN ABSOLUTE NECESSITY SOONER THAN WE HAD EXPECTED. PURIFICATION PROCESSES ARE POLLUTIONAL PROCESSES. THE ENTROPY ANALOGY OF POLLUTION PROCESSES INDICATES THAT THE ROLE OF CHEMICALS WILL BECOME A CONTINUOUSLY DECLINING ONE. THE SHIFT IN ECONOMIC WILL, ON THE OTHER HAND, DICTATES THAT CHEMICAL ENGINEERS, MANAGERS AND TECHNOLOGISTS WILL BECOME MORE AND MORE INVOLVED IN WASTE PREVENTION. THE SUCCESS OF THE INDIVIDUALS, AND THE PLANTS WITH WHICH THEY ARE ASSOCIATED, WILL BE CLOSELY RELATED TO THEIR SKILLS IN THIS AREA. REGULATION WILL CHANGE SHARPLY, AND WILL BE SUPPORTED BY PUBLIC DEMAND BASED ON THE ALL TOO OBVIOUS EFFECTS OF INCREASING POPULATION DENSITY. THESE FACTS WILL BE A TREMENDOUS THREAT AND SOURCE OF LOSS TO SOME, AND A REAL OPPORTUNITY FOR COMPETITIVE ADVANTAGE FOR THOSE WHO CAN SENSE THESE CHANGES AND ADAPT IN TIME. (W69-08045).

REFERENCE LIST

00209. WATER RECLAMATION WITH GRANULAR ACTIVATED CARBON.

COOPER, J.C.; HAGER, D.G.
WATER REUSE, AMER INST CHEM ENG PROGR SYMP, 78(3), 185-192, 1967.

THE COSTS AND EFFICIENCY OF WATER RECLAMATION BY ACTIVATED CARBON ARE SUMMARIZED AND PROCESSING DESIGN PARAMETERS ARE TABULATED FOR OPTIMIZING ENGINEERING DECISIONS IN REUSE. THE PRESENT STATE OF ACTIVATED CARBON SYSTEM DEVELOPMENT SUGGESTS THAT THE PROCESS IS IMMEDIATELY APPLICABLE TO MANY MUNICIPAL AND INDUSTRIAL WASTES FOR POLLUTION ABATEMENT OR FOR WATER RECLAMATION. MUNICIPAL WASTE WATER RECLAMATION COULD PRODUCE POTABLE WATER AT 16 CENTS PER 1,000 GAL AT AN INVESTMENT OF $33 MILLION. THIS MAY BE COMPARED TO THE RECENT PROPOSAL TO BUILD A SEA-WATER DESALINATION PLANT IN SOUTHERN CALIFORNIA TO SUPPLY 150 MGD AT 23-30 CENTS PER 1,000 GAL AT AN INVESTMENT OF $300 MILLION. (W69-08050)

00210. SUCCESSES AND FAILURES IN WATER REUSE.

MAYES, W.W.; GIBSON, W.E.
WATER REUSE, AMER INST CHEM ENG PROGR SYMP, 78(63), 197-200, 1967.

AN OIL REFINERY'S EXPERIENCE WITH USING RECLAIMED MUNICIPAL WASTE WATER FOR 15 YEARS IS DISCUSSED AND ECONOMIC DATA ARE PRESENTED TO AID IN MAKING DECISIONS IN THE CHOICE BETWEEN USING SEWAGE EFFLUENTS AND OTHER SOURCES OF POOR-QUALITY WATER. FOAMING, CORROSION, AND EXCESSIVE GYPSUM CONTENT OF THE WATER WERE THE ONLY PROBLEMS ENCOUNTERED. (W69-08051)

00211. OPTIMIZATION OF A CLASS OF RIVER AERATION PROBLEMS BY THE USE OF MULTIVARIABLE DISTRIBUTED PARAMETER CONTROL THEORY.

TARASSOV, V.J.; PERLIS, H.J.; DAVIDSON, B.
WATER RESOURCES RESEARCH, 5(3), 563-573, 1969.

MATHEMATICAL PROGRAMMING METHODS APPLIED TO WATER POLLUTION PROBLEMS HAVE BEEN HIGHLY SUCCESSFUL, ESPECIALLY IN CASES WHERE HYPOTHETICAL MODELS WERE USED. IN MANY APPLICATIONS, LINEAR PROGRAMMING, DYNAMIC PROGRAMMING, OR PONTRYAGIN'S MAXIMUM PRINCIPLE METHODS HAVE BEEN DEMONSTRATED USING STEADY STATE STREETER-PHELPS SYSTEM EQUATIONS AT SOME STAGE IN THE OPTIMIZATION STUDY. THE AUTHORS PROPOSE TO EXAMINE THE APPLICATION OF THE SIRAZETDINOV-TRASSOV-PERLIS THEORY OF OPTIMAL CONTROL TO THE ARTIFICIAL IN-STREAM AERATION PROBLEM IN POLLUTED RIVERS. THE MAIN CONCERN OF THE STUDY IS TO SHOW HOW ARTIFICIAL IN-STREAM AERATION CAN BE CONTROLLED SO AS TO MINIMIZE THE RELATIVE COST OF OPERATION FOR SEVERAL COMPETING DESIGN CRITERIA. THE ECONOMIC ASPECTS OF COST MINIMIZATION OF THIS PROCESS HAS IMPORTANT THEORETICAL IMPLICATIONS AND POTENTIAL APPLICATIONS TO SPECIFIC WATER POLLUTION PROBLEMS. (W69-08061)

00212. ECONOMY OF WATER QUALITY MANAGEMENT AND POLLUTION CONTROL.

PLANNERY, J.J.
THE FRESH WATER OF NEW YORK STATE: ITS CONSERVATION AND USE, PP 51-57, WM C BROWN BOOK CO., DUBUQUE, IOWA, 1969.

THIS PAPER DESCRIBES THE DIMENSIONS OF THE WATER POLLUTION PROBLEM; INDICATING THE SOURCES, THE KINDS, THE EFFECTS, AND THE MAGNITUDES OF POLLUTION, SO FAR AS THEY ARE KNOWN. THE ECONOMIC ASPECTS OF POLLUTION ARE BASED ON THE CONFLICTS BETWEEN WASTE DISPOSAL AND OTHER USES OF THE PUBLIC WATERS. THE GREATEST CONFLICT IS WITH THE USES THAT TAKE PLACE IN THE PUBLIC WATERS THEMSELVES--FISHING, RECREATION, AND AESTHESTICS. THE WITHDRAWAL USES ARE ALSO AFFECTED BUT THOSE EFFECTS MAY BE CORRECTED BY WATER TREATMENT. AN OPTIMUM ARRANGEMENT AMONG USES, INCLUDING WASTE DISPOSAL, CAN BE DETERMINED BY ANALYZING INCREMENTAL COSTS AND BENEFITS OR BY CALCULATING THE BENEFIT AND COST VARIATIONS AMONG DIFFERENT LEAST-COST ALTERNATIVES. FURTHERMORE, THE PAPER SAYS THAT REQUIRING WASTE DISPOSERS TO PAY IN PROPORTION TO THEIR USE OF THE PUBLIC WATERS FOR DISPOSAL PROBABLY WOULD FACILITATE THE OPTIMIZATION PROCESS CONSIDERABLY, FOR IT WOULD CAUSE THE WASTE DISPOSERS TO BE COST-CONSCIOUS TO THE EXTENT THAT THEY WOULD REDUCE WASTES TO SAVE MONEY. INTENSIVE STUDY OF THE IDEA IS URGED. (W69-08079).

00213. LICKING RIVER AND TRIBUTARIES, OHIO (FLOOD CONTROL AND ALLIED PURPOSES).

U S CONGR, 2D SESS, HOUSE DOC NO 337, 192 P, 1968.

IN DETERMINING THE ADVISABILITY OF PROVIDING IMPROVEMENTS FOR THE ASSESSED WATER RESOURCES NEEDS WITHIN THE LICKING RIVER BASIN, OHIO, SEVERAL RESERVOIRS WERE CONSIDERED FOR BOTH MULTIPLE AND SINGLE PURPOSE DEVELOPMENT. ONLY UTICA RESERVOIR ON NORTH FORK OF LICKING RIVER WAS FOUND TO BE ECONOMICALLY JUSTIFIABLE. THE UTICA PROJECT WOULD PROVIDE FOR THE WATER SUPPLY AND WATER QUALITY CONTROL NEEDS OF THE BASIN UNTIL THE YEAR 2020, WOULD PROVIDE RECREATION OPPORTUNITIES TO SOME 450,000 VISITORS ANNUALLY, AND WOULD PROVIDE REDUCTIONS OF FLOOD CRESTS ALONG NORTH FORK. TO FURTHER ALLEVIATE THE SEVERAL AND FREQUENT FLOODING AT NEWARK, SEVERAL LOCAL PROTECTION SCHEMES WERE INVESTIGATED FOR THREE INDEPENDENT AREAS. ECONOMICALLY FEASIBLE PROJECTS WERE DEVELOPED FOR THE PROTECTION OF A RAPIDLY EXPANDING RESIDENTIAL AREA ALONG LOG POND RUN, FOR IMPROVING THE INTERIOR DRAINAGE FACILITIES BEHIND THE EXISTING FEDERAL LEVEE, AND FOR IMPROVEMENT OF THE NORTH FORK CHANNEL. ACTING AS A SYSTEM, UTICA RESERVOIR AND THE IMPROVMENT OF THE NORTH FORK CHANNEL WOULD PREVENT 91% OF THE AVERAGE ANNUAL DAMAGES ALONG NORTH FORK IN NEWARK. THE DIVERSION PLAN WOULD REDUCE AVERAGE ANNUAL DAMAGES ALONG LOG POND RUN BY 73%. IMPROVEMENT OF THE INTERIOR DRAINAGE FACILITIES WOULD ELIMINATE A SERIOUS HEALTH HAZARD AND WOULD PREVENT FLOOD DAMAGES DUE TO INSUFFICIENT PUMPING CAPACITY. THE SURVEY REPORT CONCLUDES THAT UTICA RESERVOIR, THE LOG POND RUN DIVERSION PROJECT, IMPROVEMENT OF INTERIOR DRAINAGE FACILITIES OF THE COMPLETED LOCAL PROTECTION PROJECT AND IMPROVEMENT OF 5,900 FEET OF THE CHANNEL OF NORTH FORK OF LICKING RIVER SHOULD BE ADDED AS UNITS IN THE PLAN OF WATER RESOURCES DEVELOP-

MENT FOR THE LICKING RIVER BASIN TO SUPPLEMENT EXISTING PROJECTS OF THE CORPS OF ENGINEERS. (W69-01647).

00214. COOLING WATER SOURCES FOR POWER GENERATION.

HAUSER, L.G.

ASCE NATIONAL WATER RESOURCES MEETING, MEMPHIS, TENNESSEE, JAN 26-30, 1970, 22 P.

THE FORECAST OF FUTURE ELECTRICITY PRODUCTION IN THE U. S. A. IS PROJECTED; AND THE POSSIBILITIES OF COOLING OF THE FUTURE RELEASED HEAT ARE DISCUSSED. THE FORECAST IS MADE UP TO THE YEAR 2000 AND SHOWS THAT RESIDUAL HEAT DISSIPATION WILL BE A SERIOUS PROBLEM FOR FUTURE GENERATING PLANTS. THE FURTHER MAIN CONCLUSIONS 958 ' ' THE COST OF ALTERNATE HEAT DISSIPATION METHODS IS NOT PROHIBITIVE AND WILL NOT DETER THE GROWTH IN DEMAND FOR ELECTRIC POWER. (2) APPROXIMATELY 70% OF NEW BASE LOAD GENERATING STATIONS WILL REQUIRE SUPPLEMENTAL COOLING SYSTEMS BY 1980, (3) COST PENALTIES OF SUPPLEMENTAL COOLING SYSTEMS CAN BE MINIMIZED WITH SOPHISTICATED ANALYTICAL TECHNIQUES. OPTIMIZATION TECHNIQUES FOR OVERALL LEAST COST OF POWER PRODUCTION AND COOLING ARE ILLUSTRATED. (70-03727).

00215. TUBE CLARIFICATION PROCESS, OPERATING EXPERIENCES.

CULP, G.L.; HSIUNG, K.; CONLEY, W.R.

ASCE J SANITARY ENGINEERING, 95(SA5), PAPER 6823, 829-847, 1969.

THE USE OF SMALL DIAMETER TUBES AS EFFICIENT SEDIMENTATION DEVICES HAS BEEN DEMONSTRATED SUCCESSFULLY ON A PLANT SCALE. SHALLOW SETTLING DEPTHS PROVIDED BY LONGITUDINAL FLOWS THROUGH TUBES RESULTS IN MORE EFFICIENT CLARIFICATION AT SHORTER DETENTION TIMES AND LESS COST THAN FOR CONVENTIONAL CLARIFIFCATION METHODS. TUBES MAY BE ESSENTIALLY HORIZONTAL SUCH THAT TUBE CLARIFICATION IS FOLLOWED BY FILTRATION PROCESS AND SETTLE SOLIDS IN TUBES DRAINED INCIDENT TO FILTER BACKWASH. BY STEEPLY INCLINING THE TUBES, SETTLED SOLIDS DO NOT ACCUMULATE IN TUBES BUT SLIDE INTO THE PLENUM BENEATH THE TUBES, PRECLUDING TUBE DRAINAGE. MODULES OF STEEPLY INCLINED TUBES HAVE INCREASED THE CAPACITY OF CLARIFIERS FROM 2 TO 4 TIMES. STEEPLY-INCLINED TUBE PROCESS HAS BEEN APPLIED TO RAW WATER CLARIFICATION, PRIMARY, SECONDARY AND TERTIARY SEWAGE TREATMENT IN PLANTS UP TO 45 MGD CAPACITY. THE SIZE AND COST OF NEW CLARIFIERS CAN BE REDUCED BY INCLUDING THE TUBE CONCEPT IN THE ORIGINAL DESIGN AND CONSTRUCTION. (W70-03911).

00216. A BREAKTHROUGH IN THE TRACER STUDIES OF SEDIMENTATION TANKS.

THIRMURTHI, D.

J WATER POLLUTION CONTROL FED., 41(11), PART 2 P R405-R418, 1969.

INCREASING COSTS OF WASTE TREATMENT COMPEL DESIGN-ORIENTED RESEARCH WITH VIEW TOWARD REDUCING TREATMENT COSTS. SEDIMENTATION IS CONSIDERED A VITAL PHASE JUSTIFYING CLOSER ANALYSIS. TRACER STUDIES AND SEDIMENTATION TESTS WERE CONDUCTED ON TWO CONTINUOUS-FLOW LABORATORY MODEL SETTLING TANKS OF SIMILAR GEOMETRY EXCEPT LENGTH-WIDTH RATIOS. TRACER STUDIES OF PULSE INPUT TECHNIQUE WERE MADE TO DEMONSTRATE THAT TWO SELECTED PARAMETERS WERE REPRODUCIBLE AND USEFUL AS DESIGN CRITERIA FOR SEDIMENTATION SYSTEMS. THE STUDY IS UNIQUE IN THE FACT THAT RESULTS OF TRACER TESTS HAVE BEEN INTER-RELATED SITH RESULTS OF SEDIMENTATION TEST ON THE CONTINUOUS-FLOW MODELS. THE DEVIATION OF REAL SYSTEMS FROM THE IDEALITY HAS BEEN CONSIDERED. A DESIGN FORMULA FOR ACTUAL SEDIMENTATION TANKS HAS BEEN SUGGESTED. FURTHER STUDIES OR SIMULATIONS ARE NEEDED TO VALIDATE THE SUGGESTED DESIGN FORMULA. A METHOD IS DEVELOPED TO EVALUATE THE RELATIVE ADVANTAGES OF GEOMETRIC DESIGN FEATURES OF SEDIMENTATION TANKS. (W70-03922).

00217. PHYSICOCHEMICAL TREATMENT OF WASTEWATER.

WEBER, W.J.; HOPKINS, C.B.; BLOOM, R. JR.,.

JOURNAL WATER POLLUTION CONTROL FEDERATION, 42, 83-89, 1970.

CONVENTIONAL'SECONDARY' BIOLOGICAL WASTE TREATMENT PROCESSES ARE INADEQUATE TO PROVIDE THE EFFLUENT QUALITY NEEDED FOR WATER REUSE PURPOSES OR TO PROVIDE A SATISFACTORY DEGREE OF POLLUTION PROTECTION TO RECEIVING NATURAL WATER BODIES, BASED ON ANTICIPATED, MORE STRINGENT FUTURE DEMAND. A PROCESS USING CHEMICAL CLARIFICATION, FILTRATION, AND ADSORPTION BY ACTIVATED CARBON FOR TREATMENT OF PRIMARY WASTES WAS DESIGNED AND TESTED ON A PILOT-SCALE BASIS. THE PHYSICOCHEMICAL TREATMENT PROCESS IS A MAJOR DEPARTURE FROM THE COSTLIER PRACTICE OF TERTIARY TREATMENT METHODS FOLLOWING CONVENTIONAL SECONDARY TREATMENT. THE SYSTEM WAS DESIGNED FOR ESSENTIALLY AUTOMATIC OPERATIONS. THE PHYSICOCHEMICAL PILOT MODEL PHASE WAS OPERATED CONTINUOUSLY FOR 4 MONTHS. CONSISTENT TOTAL ORGANIC CARBON AND BIOCHEMICAL OXYGEN DEMAND REMOVALS OF 95%-97%, PHOSPHATE REMOVALS OF 90% AND NITRATE REMOVALS OF 95% WERE OBTAINED. COSTS ARE ABOUT $0.16/1,000 GAL., INCLUDING CAPITAL AMORTIZATION. PROCESS AFFORDS FLEXIBILITIES TO EXPAND ON A MODULAR BASIS AND TO INTENSIFY DEGREE OF TREATMENT. (W70-03927).

00218. EXAMINATION INTO THE EFFECTIVENESS OF THE CONSTRUCTION GRANT PROGRAM FOR ABATING, CONTROLLING AND PREVENTING WATER POLLUTION.

REPORT TO CONGRESS, NOV 3, 1969, 164 P.

THE STUDY EXAMINED THE EFFECTIVENESS OF THE CONSTRUCTION GRANT PROGRAM ADMINNSTERED BY THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION FOR ABATING, CONTROLLING AND PREVENTING WATER POLLUTION IN THE UNITED STATES. THE DEVELOPMENT AND USE OF A SYSTEMS ANALYSIS METHOD, AND ITS PRACTICABILITY IN AN ACTUAL WATERWAY WAS DISCUSSED. A MATHEMATICAL MODEL WAS DEVELOPED BY CAMP, DRESSER AND MCKEE AND USED TO EVALUATE DATA ON THE MERRIMACK RIVER FOR ESTIMATING THE CONSTRUCTION COSTS OF WATER TREATMENT FACILITIES FOR VARIOUS DEGREES OF WATER QUALITY. IT WAS CONCLUDED THAT THROUGH THE USE OF THE SYSTEM ANALYSIS APPROACH TO PLANNING AND IMPLEMENTING WATER POLLUTION PROGRAMS (A) A LEAST-COST CONSTRUCTION PLAN TO ACHIEVE WATER QUALITY STANDARDS COULD BE MADE, (B) MORE COSTLY BUT PERHAPS DESIRABLE ALTERNATIVE SCHEDULES COULD BE DEVELOPED AND (C) DECISION MAKERS WOULD BE PROVIDED WITH MORE MEANINGFUL DATA AS TO ENABLE THEM TO ACHIEVE ESTABLISHED OBJECTIVES AND THE COSTS OF PROVIDING VARIOUS LEVELS OF WATER USES. (W70-03936).

REFERENCE LIST

00219. SIMULATION MODEL FOR FLOW AUGMENTATION COSTS.

PEREZ, A.I.; SCHAAKE, J.C.; PYATT, E.E.
J HYDRAUL DIV, PROCEEDINGS OF ASCE, 96(HY1), 131-142, 1970.

A GENERALIZED MATHEMATICAL MODEL WAS DEVELOPED TO PERMIT THE SIMULATION OF THE ECONOMIC AND PHYSICAL INTERACTIONS OF SEWAGE TREATMENT AND LOW FLOW AUGMENTATION, AND SUBSEQUENT EVALUATION FROM A WATER QUALITY STANDPOINT. AN ESSESNTIAL PHASE OF THE PROJECT, A STUDY OF LOW FLOW AUGMENTATION STORAGE COSTS WAS ANALYZED. THE MAIN OBJECTIVE WAS TO OBTAIN OPTIMUM FUNCTIONAL RELATIONSHIPS BETWEEN THE STORAGE VOLUME REQUIRED AND THOSE VARIABLES THAT WERE FOUND TO AFFECT IT. THE RESULTS COULD THEN BE INTERGRATED WITH REGIONAL COST CURVES TO GIVE GENERALIZED COST EXPRESSIONS. INITIALLY, MONTHLY STREAMFLOW AND DEMAND RECORDS WERE GENERATED FROM HISTORICAL DATA BY A COMPUTER PROGRAM. THE OPERATION OF VARIOUS RESERVIOR SIZES WAS SIMULATED AND THE NUMBER OF DEFICIENCIES DURING THE TIME PERIOD CONSIDERED WERE COUNTED. AFTER THIS PROCESS WAS REPEATED FOR SEVERAL COMBINATIONS OF VALUES OF THE VARIABLES, THE DESIRED REGRESSION, OR THE 'BEST FIT', EQUATION WAS DERIVED WHICH RELATED STORAGE VOLUME REQUIRED TO THESE PARAMETERS. (W70-03940).

00220. TRICKLING FILTER MODEL: DESIGN AND COST FACTORS.

ROESLER, J.F.; SMITH, R.
INDUSTRIAL WATER ENGINEERING, 6(9), 46-49, 1969.

A MATHEMATICAL MODEL OF A TRICKLING FILTER FINAL SETTLING PROCESS WAS DESCRIBED IN THE STUDY. THE MODEL CONSTITUTED A SINGLE SUBROUTINE IN A COMPUTER PROGRAINE SPECIFICALLY COMPUTED THE RELATIONSHIP OF THE VARIOUS PHYSICAL PROPERTIES OF THE TRICKLING FILTER, BOD REMOVAL EFFICIENCIES, AND COSTS. THE LATTER INCLUDED CAPITAL

MAINTENANCE COSTS FOR THE TRICKLING FILTER, FINAL SETTLER AND RETURN PUMPS. THE COST TO REMOVE BOD WAS PLOTTED AGAINST THE HYDRAULIC LOADING. FOR FILTER DEPTHS OF 6 AND 20 FEET, MINIMUM COSTS WERE OBSERVED NEAR HYDRAULIC LOADINGS OF 10 AND 20 MGD PERACRE, RESPECTIVELY. PLOTS OF TOTAL COSTS RATHER THAN COSTS PER BOD REMOVED INDICATED THAT THE GREATER THE SPECIFIC AREA, THE LOWER THE COSTS. (W70-03947).

00221. RX FOR AILING LAKES--A LOW PHOSPHATE DIET.

ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 3(12), 1243-1245, 1969.

STUDY WAS INITIATED IN 1964 WHEN THE INTERNATIONAL JOINT COMMISSION OF THE U S AND CANADA ESTABLISHED ADVISORY GROUPS OF STATUS OF POLLUTION IN LAKES ERIE AND ONTARIO AND SEGMENTS OF THE ST LAWRENCE RIVER. REPORT RECOMMENDS TECHNICAL AND LEGISLATIVE MACHINERY FOR CONTROL MEASURES. DETERGENTS' PHOSPHATE CONTENT SHOULD BE REDUCED IMMEDIATELY TO MINIMUM PRACTICAL LEVELS, WITH COMPLETE REPLACEMENT OF PHOSPHORUS WITH LESS INNOCUCOUS SUBSTANCES NO LATER THAN 1972. 80% REMOVAL OF PHOSPHATE FROM ALL EFFLUENTS SHOULD BE EFFECTED BY 1972 IN THE LAKE ERIE BASIN AND BY 1975 IN LAKE ONTARIO. TREATMENT OF WASTE EFFLUENTS FOR PHOSPHATE REMOVAL MUST BE IN ADDITION TO, NOT A SUBSTITUTE FOR DETERGENT REFORMULATION. PHOSPHORUS AND NITROGEN ARE RECOGNIZED AS THE MAJOR NUTRIENTS RESPONSIBLE FOR EUTROPHICATION; IT IS APPARENT THAT PHOSPHATE IS THE CONTROLLING FACTOR IN ENRICHMENT OF LOWER GREAT LAKES. EFFICIENT AND RELATIVELY INEXPENSIVE METHODS ARE AVAILABLE FOR 80-95% REMOVAL OF PHOSPHORUS DURING SEWAGE TREATMENT, WHEREAS COMPARIABLE ELIMINATION OF NITROGEN COMPOUNDS IS NOT YET FEASIBLE. COSTS FOR PHOSPHATE REMOVAL AT TREATMENT PLANTS WOULD BE REDUCED BY ONE-HALF TO TWO-THIRDS WITH REPLACEMENT OF PHOSPHATE DETERGENT BUILDERS. (W70-03964).

00222. ECONOMIC ANALYSIS IN WATER QUALITY MANAGEMENT.

CRUTCHFIELD, J.A.
WATER RESOURCES MANAGEMENT AND PUBLIC POLICY, SEATTLE, UNIVERSITY OF WASHINGTON PRESS, P 129-138, 1968.

THE PRINCIPLES UNDERLYING OPTIMAL AND SUBOPTIMAL SYSTEMS OF WATER QUALITY MANAGEMENT IS DISCUSSED. EXAMINATION IS ALSO CONDUCTED ON THE EFFECT OF THE DIVERGENCE OF PRIVATE AND SOCIAL COSTS AND BENEFITS IN WATER USE AS WELL AS THE COMPLICATIONS INTRODUCED BY TECHNOLOGICAL ECONOMIES OF SCALE IN WASTE DISPOSAL. THE CONTRIBUTION OF ECONOMIC ANALYSIS TO WATER QUALITY MANAGEMENT IN THE HANDLING OF RISK AND UNCERTAINTY IS DISCUSSED ALONG WITH THE PROBLEM OF THE EXTENT TO WHICH THE USES IMPAIRED BY WATER-QUALITY DEGRADATION ARE OF THE TYPES MOST DIFFICULT TO MEASURE IN ECONOMIC TERMS. THESE DIFFICULTIES, COUPLED WITH THE WIDE AREAS OF INCOMPLETE KNOWLEDGE OF HIGHLY VARIABLE PHYSICAL PARAMETERS, SUGGEST THAT WATER-QUALITY MANAGEMENT MUST IN PRACTICE BE LIMITED TO SUBOPTIMAL SYSTEMS DESIGNED TO MINIMIZE AGGREGATE WASTE-DISPOSAL COSTS SUBJECT TO ONE OR MORE CONSTRAINTS. (W70-04000.

00223. BULK TRANSPORT OF WASTE SLURRIES TO INLAND AND OCEAN DISPOSAL SITES: SUMMARY REPORT.

WASP, E.J.; THOMPSON, T.L.; SNOEK, P.E.; KENNY, J.P.; CARNEY, J.C.
FEDERAL WATER POLLUTION ADMINISTRATION RESEARCH SERIES REPORT DAST-16, DEC 1969.

THIS IS THE SUMMARY REPORT OF A THREE VOLUME STUDY PRINCIPALLY CONCERNED WITH THE DEVELOPMENT OF REGIONAL LAND AND OCEAN PIPELINE DISPOSAL SYSTEMS FOR DIGESTED SEWAGE SLUDGE AND MAINTENANCE DREDGINGS. IN VOLUME I TWO STUDY CASES ARE PRESENTED, NAMELY, A LAND DISPOSAL SYSTEM FOR NORTHEAST OHIO (CLEVELAND-CANTON) AND AN OCEAN DISPOSAL SYSTEM FOR THE BALTIMORE-WASHINGTON REGION. A SYSTEMS APPROACH IS USED, IN WHICH COLLECTION, TRANSPORTATION, AND DISPOSAL ASPECTS ARE EXAMINED IN LIGHT OF TECHNICAL, ECONOMIC AND SOCIAL REQUIREMENTS. VARIOUS TRANSPORT MODES ARE COMPARED, INCLUDING PIPELINE, OCEAN TANKERS, RAILROADS, AND TRUCKS. TO A LESSER EXTENT, THE STUDY ALSO CONSIDERS THE EXPANSION OF SUCH SYSTEMS TO INCLUDE FLY ASH AND WATER TREATMENT PLANT SLUDGE. IN VOLUME II PRESENT METHODS AND COSTS OF DISPOSAL FOR ALL FOUR WASTES ARE REVIEWED. ENVIRONMENTAL CRITERIA ARE PRESENTED FOR EXAMINING BOTH LAND AND OCEAN SLUDGE DISPOSAL ALTERNATIVES IN TERMS OF GENERAL SOLUTION FOR TWO BROAD METROPOLITAN REGIONS, NAMELY, THE GREAT LAKES REGION FROM BUFFALO TO MIL-

WAUKEE AND THE ATLANTIC COAST REGION FROM BOSTON TO NORFOLK. RESULTS OF A LOOP TEST PROGRAM UTILIZING 12 IN AND 16 IN PIPE FOR PUMPING DIGESTED SLUDGE, FLY ASH, AND SLUDGE-FLY ASH SLURRIES ARE INCLUDED IN VOLUME III AS WELL AS CORRESPONDING RHEOLOGICAL TESTS WITH A 1/2 IN SMALL TUBE VISCOMETER AND A ROTATIONAL LAB VISCOMETER. A PROCEDURE FOR PREDICTING HEAD LOSSES IS GIVEN, AS WELL AS A REVIEW OF THE STATE OF THE ART OF PIPELINING OF WASTE MATERIALS. (PB-189 756) (W70-04004).

00224. BULK TRANSPORT OF WASTE SLURRIES TO INLAND AND OCEAN DISPOSAL SITES: VOLUME I - THE WASTE MANAGEMENT CONCEPT.

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION RESEARCH SERIES REPORT DAST-16, 1(9), 156P, 1969.

BASIC ENVIRONMENTAL CRITERIA WERE STUDIED FOR DISPOSAL OF SELECTED WASTE MATERIALS, INCLUDING SEWAGE TREATMENT PLANT SLUDGE, MAINTENACE DREDGINGS, POWER PLANT FLY ASH, AND FILTER PLANT RESIDUES. BOTH LAND AND OCEAN DISPOSAL ALTERNATIVES WERE EXAMINED IN TERMS OF A GENERAL SOLUTION FOR 2 BROAD REGIONS, NAMELY THE GREAT LAKES MEGALOPOLIS FROM MILWAUKEE TO BUFFALO AND THE THE ATLANTIC COAST MEGALOPOLIS FROM BOSTON TO NORFOLK. PRESENT METHODS AND COSTS OF DISPOSAL HAVE BEEN INCLUDED TO COMPLETE THE PICTURE OF THE OVERALL WASTE DISPOSAL PROBLEM. (W70-04006).

00225. BULK TRANSPORT OF WASTE SLURRIES TO INLAND AND OCEAN DISPOSAL SITES: VOLUME II -CRITERIA FOR WASTE MANAGEMENT.

SNOEK, P.E.

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION RESEARCH SERIES REPORT DAST-16, 2(9), 144 P, 1969.

DEVELOPMENT OF A SPECIFIC WASTE MANANGEMENT SYSTEM WHICH COLLECTS, TRANSPORT AND DISPOSES OF SEWAGE SLUDGE AND MAINTENACE DREDGING IN A SOCIALLY, TECHNICALLY, AND ECONOMICALLY SATISFACTORY FASHION WAS STUDIED BY SYSTEMS ANALYSIS. THE FEASIBILITY OF CONTRUCTING AND OPERATING A DEMONSTRATION PROJECT WAS EXAMINED. A MAJOR EFFORT IN THIS AREA IS THE DEMONSTRATION PROJECT BY THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO USING SEWAGE SLUDGE FOR AGRICULTURE. FOR EACH DETAILED STUDY CASE, A DISPOSAL SYSTEM IS PROPOSED WHICH EFFECTIVELY SERVES REGIONAL NEEDS, IS ECONOMICALLY SOUND, AND INCLUDES THE COLLECTION, TRANSPORTATION AND DISPOSAL OF THE ESTIMATED PRODUCTION OF WASTES UP TO THE YEAR 2000. THE ECOMOMICS OF THE SYSTEMS ARE PRESENTED AND RECOMMENDATIONS ARE MADE AS HOW TO ACHIEVE BOTH IMMEDIATE AND LONG-TERM OBJECTIVES. FOR AN IMMEDIATE SOLUTION TO THE NATIONAL PROBLEM OF WASTE DISPOSAL OF DIGESTED SEWAGE SLUDGE, A LAND DISPOSAL SYSTEM IS RECOMMENDED. A LONG-TERM, SUCCESSFUL HISTORY OF BENEFICALLY USING SLUDGE ON LAND IS AVAILABLE. THE COST BENEFIT RATIO OF THE SLUDGE DISPOSAL SYSTEM IS VERY FAVORABLE. A DEMONSTRATION PROJECT IS RECOMMENDED TO PROVE THE VIABILITY OF THE CONCEPT. PIPELINE TRANSPORTATION IS ECONOMICALLY BETTER THAN OTHER MODES EVALUATED. (PB-189 757) (W70-04005).

00226. POLLUTION AT THE SOUTHERN END OF LAKE MICHIGAN (WATER POLLUTION).

VAUGHN, J.C.

AM WATER WKS ASS'N J, 61(11) 603-609, 1969.

THE CHICAGO-SOUTHERN LAKE MICHIGAN AREAS HAS A LONG HISTORY OF BATTLING WATER POLLUTION. VARIOUS ADMINISTRATIVE BOARDS–STATE, REGIONAL, AND FEDERAL--HAVE BEEN FORMED TO DEAL WITH THE PROBLEM. MATERIAL PRESENTED AT CONFERENCES OF THESE BOARDS REVEALS THE SCOPE OF THE POLLUTION PROBLEM. DOMESTIC SEWAGE POLLUTION HAS BEEN SOMEWHAT ALLEVIATED, BUT DATA COLLECTED FROM THE SEVERAL SAMPLING POINTS IN THE CHICAGO METROPOLITAN AREA AND IN LAKE MICHIGAN REVEAL THAT CHEMICAL AND BACTERIAL POLLUTION IS STILL A SERIOUS PROBLEM. POLLUTANTS SUCH AS AMMONIA NITROGEN, COLIFORM ORGANISMS, PLANTON, PHENOL AND HYDROCARBONS ARE MUCH IN EVIDENCE AS SHOWN BY SEVERAL GRAPHS AND TABLES AND THE PREVAILING TREND IS TOWARD MORE POLLUTION. RISING POLLUTION TREATMENT COSTS HAVE ADDED TO THE DIFFICULTIES. INDUSTRIAL WASTES ARE INCREASING, GIVING RISE TO THE PLANKTON POLLUTION AND OFFENSIVE TASTES AND ODORS IN THE WATER. THE ARTICLE STATES THAT UNLESS THERE IS A QUANTITATIVE REDUCTION IN THESE INDUSTRIAL WASTES, THERE WILL BE LITTLE CHANCE TO IMPROVE WATER QUALITY. (W70-04211).

00227. RECEIVING-WATER MONITORING: KEY TO SEATTLE METRO'S POLLUTION-ABATEMENT PROGRAM.

GIBBS, C.V.

WATER RESOURCES MANAGEMENT AND PUBLIC POLICY, UNIVERSITY OF WASHINGTON PRESS, 1968. P 179-186.

THE POLLUTION ABATEMENT AND PREVENTION PROGRAM UNDERTAKEN BY THE MUNICIPALITY OF METROPOLITAN SEATTLE (METRO) IN 1959 IS OUTLINED. WORKING UNDER THE PHILOSPHY THAT A DISCHARGER HAS THE RESPONSIBILITIES FOR MONITORING ITS RECEIVING WATERS, METRO HAS ESTABLISHED A WATER QUALITY CONTROL DIVISION AND HAS ASSIGNED IT THE TASK OF PLANNING AND IMPLEMENTING THE NECESSARY PROGRAMS. COST FOR THE ENTIRE PROGRAM ($135 MILLION BY 1972) AND COSTS AND BENEFITS FOR SPECIFIC ASPECTS OF IT ARE INDICATED. WARER-QUALITY MONITORING WAS RECOGNIZED AT THE OUTSET TO BE OF CRITCAL IMPORTANCE BECAUSE OF CONSERVATIONISTS'S OPPOSITION REGARDING EFFLUENT DISPOSAL WHEN THE PLAN WAS PRESENTED TO STATE REGULATORY AGENCIES IN 1960. THE MONITORING AND REVIEW REQUIREMENTS ESTABLISHED BY THE POLLUTION CONTROL COMMISSION ARE OUTLINED ALONG WITH A SET OF SIX OBJECTIVES OF THE METRO PROGRAM. THREE DIVISIONS OF THE PROGRAM--A WATER QUALITY SECTION, AN ECOLOGICAL SECTION, AND AN INDUSTRIAL WASTE SECTION--ARE POINTED OUT AND THE DISTINCT PROBLEMS AT EACH OF THE FOUR SPEARATE MONITORING PROGRAMS INDICATED. THE GREEN-DUWAMISH RIVER PROGRAM INVOLVES A FRESH-WATER STREAM AND ITS TERMINAL ESTUARY. PUGET SOUND IS AN ARM OF THE PACIFIC OCEAN. LAKE WASHINGTON-LAKE SAMMAMISH DRAINAGE BASIN REQUIRES WORK ON THE LARGE LAKES AND MANY SMALL TRIBUTARY STREAMS. LAKE WASHINGTON SHIP CANAL SYSEM NECESSITATES WORK ON SEVERAL SMALL LAKES CONNECTED BY DEEP WATER CANALS INFLUENCED BY INTRUSION OF SALT-WATER. COOPERATIVE STUDIES WITH THE U. S. GEOLOGICAL SURVEY ARE MENTIONED AND DETAILS OF THE ELECTRONIC DATA-PROCESSING SYSTEM PRESENTED. (W70-05452).

REFERENCE LIST

00228. COST AND PERFORMANCE ESTIMATES FOR TERTIARY WASTEWATER TREATING PROCESSES.

SMITH, R.; MCMICHAEL, W.F.
ROBERT A. TAFT WATER RESEARCH CENTER REPORT NO TWRC-9, FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, JUNE 1969. 27 P.

GENERALIZED ESTIMATES OF BOTH PERFORMANCE AND COST ARE DERIVED FOR WASTEWATER TREATMENT PROCESSES WHICH CAN BE USED WITH ACTIVATED SLUDGE PROCESS TO REDUCE THE POLLUTION LOAD ON THE RECEIVING STREAM. PROCESSES AND GROUPS OF PROCESSES BELIEVED TO BE LEADING CANDIDATES FOR USE DOWNSTREAM OF SECONDARY TREATMENT ARE LISTED. DATA FROM VARIOUS SOURCES ON THE FRACTION OF 5-DAY BOD ASSOCAITED WITH SUSPENDED SOLIDS ARE TABULATED. MICROSCREENING OR RAPID SAND FILTRATION REMOVES ABOUT 42% OF THE 5-DAY BOD AND 21% OF THE COD AND TOC. OTHER SOLIDS-REMOVING PROCESSES, SUCH AS LIME CLARIFICATION, MULTIMEDIA FILTRATION, AND GRANULAR CARBON ADSORPTION, REMOVE A GREATER FRACTION OF THE SUSPENDED SOLIDS. SOME OF THE DISSOLVED ORGANIC CONTAMINANTS MIGHT BE REMOVED, BUT THIS APPEARS TO BE NEGLIGIBLE. A LARGE FRACTION OF THE DISSOLVED ORGANIC SPECIES IS REMOVED BY GRANULAR CARBON ADSORPTION. ESTIMATES OF THE CONCENTRATIONS OF BOD, COD, TOC, NITROGEN, AND PHOSPHORUS DOWNSTREAM OF EACH GROUP OF PROCESSES ARE TABULATED. ESTIMATED CAPITAL AND OPERATING AND MAINTENANCE COSTS FOR EACH PROCESS ARE SHOWN. (PB-189 953) (W70-04298).

00229. THE IMPACT OF MINE DRAINAGE POLLUTION ON INDUSTRIAL WATER USERS IN APPALACHIA.

WHITMAN, I.L.; NEHMAN, G.I.; QASIM, S.R.
APPALACHIAN REGIONAL COMMISSION REPORT ON ACID MINE DRAINAGE IN APPALACHIA, APPENDIX A, 1969. 254 P.

RIVERS AND TRIBUTARIES DRAINING COAL MINE REGIONS IN APPALACHIA RECEIVE LARGE VOLUME OF ACID MINE-DRAINAGE POLLUTION. THE EFFECTS OF ACID MINE DRAINAGE ON INDUSTRIAL WATER USERS IN APPALACHIA ARE DISCUSSED AND THE ECONOMIC IMPACTS ON THE REGION, SHOULD REDUCTIONS IN MINE-DRAINAGE POLLUTION BE ACHIEVED, ARE ESTIMATED. SIXTY-SEVEN MANUFACTURING PLANTS WERE VISITED TO OBTAIN DETAILED DATA ON INDUSTRIAL WATER USE, WATER COSTS, ADJUSTMENTS TO CURRENT LEVELS OF MINE-DRAINAGE POLLUTION, AND POTENTIAL SAVINGS FROM POLLUTION REDUCTION. PRIMARY FOCUS OF THE IN-PLANT INTERVIEWS INCLUDED THE FOOD PROCESSING, PAPER, CHEMICALS, TEXTILES, PRIMARY METALS, AND STONE AND GLASS INDUSTRIES. THE GREATEST SAVINGS TO INDUSTRY WOULD BE IN OPERATING COSTS, PARTICULARY IN REDUCED COSTS OF CHEMICALS USED FOR WASTE TREATMENT. OTHER SAVINGS WOULD RESULT FROM REDUCED MAINTENANCE, LESS FREQUENT REPLACEMENT OF EQUIPMENT, AND IN A FEW CASES, LOWER INITIAL PLANT INVESTMENT COSTS. IT IS CONCLUDED THAT REDUCTION IN MINE-DRAINAGE POLLUTION IN APPALACHIA WOULD HAVE LITTLE IMPACT ON THE ECONOMY OF THE REGION ITSELF DUE TO CHANGES IN WATER UTILIZATION BY INDUSTRY. ESTIMATES OF ANNUAL DOLLAR SAVINGS TO INDUSTRY FROM MINE DRAINAGE REDUCTION INDICATE THAT SUCH SAVINGS ARE BUT AN INSIGNIFICANT FRACTION OF TOTAL INDUSTRIAL PRODUCTION COSTS OR SALES VALUE. INDUSTRY PRODUCTION WOULD NOT BE ALTERED IN EITHER VOLUME OR COMPOSITION DUE TO REDUCTIONS IN MINE-DRAINAGE POLLUTION. (W70-04329).

00230. ENGINEERING ECONOMIC STUDY OF MINE DRAINAGE CONTROL TECHNIQUES.

APPALACHIAN REGIONAL COMMISSION REPORT ON ACID MINE DRAINAGE IN APPALACHIA APPENDIX B, 1969. 281 P.

A SERIES OF COSTS CURVE GRAPHS WERE DEVELOPED TO SERVE AS A METHOD FOR DETERMINING THE COSTS OF APPLYING VARIOUS TECHNIQUES OF CONTROLLING ACID MINE DRAINAAGE POLLUTION WHEREVER POSSIBLE, CURVES HAVE BEEN PRESENTED FOR CHANGES IN CAPITAL, OPERATING, AND MAINTENANCE COSTS WHERE THESE ARE DEPENDENT UPON THE SCALE OF APPLICATION UNDER THE VARYING SETS OF GENERAL CONDITIONS CHARACTERISTIC OF MINE DRAINAGE POLLUTED AREAS IN THE APPALACHIAN REGION. THE EFFECTIVENESS OF EACH OF THE CONTROL TECHNIQUES WAS STUDIED IN TERMS OF THE DEGREE TO WHICH MINE DRAINAGE POLLUTION IS CONTROLLED, AND THE QUALITY CHARACTERISTICS OF THE POST-TECHNIQUES WATER. THE TECHNIQUES IN THE PROPOSED OR EXPERIMENTAL STAGE THAT OFFER THE GREATEST PROMISE AND THUS WARRANT FURTHER RESEARCH AND DEVELOPMENT ARE RECOMMENDED. THE RECOMMENDED TECHNIQUES ARE NEUTRALIZATION, REVERSE OSMOSIS, STREAMFLOW REGULATION, DEEP WELL DISPOSAL, LAND RECLAMATION, REVEGETATION, PUMPING AND DRAINAGE, WATER DIVERSION, MINE SEALING, REFUSE TREATMENT, AND IMPOUNDMENT OF ACID WATER. (W70-04330).

00231. THE IMPACTS OF MINE DRAINAGE POLLUTION ON LOCATION DECISIONS OF MANUFACTURING INDUSTRY IN APPALACHIA.

APPALACHIAN REGIONAL COMMISSION REPORT ON ACID MINE DRAINAGE IN APPALACHIA, APPENDIX D, 1969. 317 P.

THE EFFECT OF MINE DRAINAGE POLLUTION NF PAST DECISIONS BY INDUSTRIAL FIRMS TO LOCATE (OR NOT TO LOCATE) WITHIN THE APPALACHIAN REGION IS DISCUSSED. TWENTY CASE HISTORIES OF PLANT LOCATION SEARCHES BY INDUSTRIES THAT ARE LARGER-THAN-AVERAGE USERS OF WATER ARE COMPILED. MARKETS WERE AN IMPORTANT CONTRIBUTORY FACTOR WHICH ELIMINATED APPALACHIA IN NINE OF THE FINAL LOCATION DECISIONS. MOST OF THE INDUSTRIES FOUND THAT ABATEMENT OF ACID MINE POLLUTION WOULD HAVE TO BE 90% OR BETTER TO INFLUENCE DECISIONS TO LOCATE. UNFAVORABLE LOCATION DECISIONS ARE CAUSED BY POOR WATER QUALITY IN THE TEXTILE DYEING, PAPER, CHEMICAL, PLASTIC, AND ALUMINUM INDUSTRIES. IN MANY OTHERS, ACID MINE DRAINAGE POLLUTION IS NOT AN IMPORTANT PLANT LOCATION FACTOR. (W70-04332).

00232. IMPACT OF MINE DRAINAGE ON RECREATION AND STREAM ECOLOGY: APPENDIX E. MINE DRAINAGE POLLUTION AND RECREATION IN APPALACHIA.

APPALACHIAN REGIONAL COMMISSION REPORT ON ACID MINE DRAINAGE IN APPALACHIA, APPENDIX E, 1969. 114 P.

AMONG THE DETRIMENTAL ASPECTS OF MINE ACID DRAINAGE IS THE IMPAIRMENT OF OUTDOOR WATER-BASED RECREATIONAL ACTIVITY. MINE ACID POLLUTION CAN INHIBIT AND MAY EVEN COMPLETELY DETER THE USE OF NATURAL WATERS FOR SWIMMING, WATER-SKIING, OR SKINDIVING, AND FOR BOTH WARM AND COLD WATER SPORT FISHING. A STUDY WAS MADE TO ESTIMATE THE MAGNITUDE OF THE ACTIVITY LOSS AND THE RESULTANT ECONOMIC (MONETARY) LOSS WHICH COULD RESULT FROM A FAILURE TO ABATE THE MINE ACID

DRAINAGE IN THE POLLUTED AREAS OF APPALACHIA CONTAINING POTENTIALLY RECREATIONAL WATERS. IF CHANGES ARE MADE IN WATER QUALITY BY VARIOUS DEGREES OF MINE ACID REDUCTION, A REGION MAY BE ABLE TO REALIZE SOME OR ALL OF THE INCOME FROM THE OTHERWISE LOST POTENTIAL RECREATION EXPENDITURE. TO THE EXTENT THAT MINE ACID WASTE ABATEMENT MAKES IT POSSIBLE TO REALIZE THAT INCREASE IN EXPENDITURES, THESE MAY BE VIEWED AS A SCHEDULE OF OPPORTUNITY BENEFITS TO WHICH THE REGIONAL INCOME MULTIPLIERS CAN BE APPLIED. (W70-04333).

00233. ARTIFICIAL-RECHARGE EXPERIMENTS UTILIZING RENOVATED SEWAGE-PLANT EFFLUENT--A FEASIBILITY STUDY AT BAY PARK, NEW YORK.

COHEN, P.; DURFOR, C.N.

ARTIFICIAL RECHARGE AND MANAGEMENT OF AQUIFERS, SYMPOSIUM OF HAIFA (MARCH 19-26 1967) INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY, PUBLICATION NO 72, P 193-199, 1967. 7 P.

THE U. S. GEOLOGICAL SURVEY, IN COOPERATION WITH THE NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS, IS CONDUCTING A SERIES OF ARTIFICIAL-RECHARGE EXPERIMENTS ON LONG ISLAND, NEW YORK TO OBTAIN SCIENTIFIC AND ECONOMIC DATA NEEDED TO EVALUATE THE FEASIBILITY OF INJECTING HIGHLY TREATED SEWAGE-PLANT EFFLUENT INTO A PROPOSED NETWORK OF 'BARRIER' INJECTION WELLS THAT ARE INTENDED TO PREVENT OR RETARD THE LANDWARD MOVEMENT OF SALTY WATER FROM THE ATLANTIC OCEAN INTO MAJOR AQUIFERS. TERTIARY SEWAGE TREATMENT WAS DEVELOPED TO PRODUCE AN EFFLUENT THAT MEETS REQUIREMENTS COMMONLY ACCEPTED FOR POTABILITY. AN EXPERIMENTAL INJECTION WELL AND INJECTION PLANT HAVE BEEN COMPLETED. REMOTE SENSING DOWNHOLE GEOCHEMICAL PROBES PERMIT THE MEASURMENT OF WATER-QUALITY AND HYDRAULIC-HEAD CHANGES AT SEVERAL POINTS WITHIN THE INJECTION WELL AND THE FILTERPACK. (W70-04355).

00234. CHICAGO'S SOUTH DISTRICT FILTRATION PLANT.

CITY OF CHICAGO DEPARTMENT OF WATER AND SEWERS, 1961. 29 P.

THE PUBLICATION DESCRIBES THE DESIGN, CONSTRUCTION AND OPERATION OF CHICAGO'S SOUTH DISTRICT FILTRATION PLANT WHICH WENT INTO FULL OPERATION IN 1947. THE PLANT, LOCATED AT LAKE MICHIGAN NEAR EAST 79TH ST., SERVES ABOUT 1,600,000 PERSONS IN A 162 SQ. MI. AREA. TWO RAW WATER INTAKES ARE PROVIDED--ONE CRIB INTAKE LOCATED 2 MILES OFFSHORE, AND A DIRECT INTAKE AT THE LAKE END OF THE PLANT. WATER ENTERING THE CRIB INTAKE IS CONVEYED BY 14 FT. AND 16 FT. DIAMETER TUNNELS LOCATED 140 FT. BELOW LAKE LEVEL. A BREAKWATER WAS BUILT TO PROTECT PLANT STRUCTURES FROM WAVE ACTION, AND A WATERTIGHT BULKHEAD WAS BUILT AROUND THE PLANT AREA. A PORTION OF THE FILTERED WATER STORAGE IS LOCATED BELOW THE FILTERS. THE TREATMENT PROCESS CONSISTS OF PRE-CHLORINATION, ADDITION OF ACTIVATED CARBON, COAGULATION WITH ALUMINUM SULFATE OR FERROUS SULFATE, FLOURIDATION, SEDIMENTATION, FILTRATION, AND POST-CHLORINATION WITH AMMONIATION. MAXIMUM PLANT CAPACITY IS 640 MGD; 1960 AVERAGE WAS 365 MGD. CONSTRUCTION COST, INCLUDING ENGINEERING AND SUPERVISION, WAS $27,052,932. ONE HUNDRED SEVENTY TWO EMPLOYEES ARE USED TO OPERATE THE PLANT. (W70-04437).

00235. THE FUTURE OF THE LAKE.

EDMONDSON, W.T.

MUNCIPALITY OF METROPOLITAN SEATTLE, METRO QUARTERLY, FALL 1965. 4 P.

ORIGINALLY SEATTLE, WASHINGTON, RELEASED NON-TREATED SEWAGE INTO PUGET SOUND AND TREATED SEWAGE INTO LAKE WASHINGTON. SWIMMING IN THE SOUND WAS DESTROYED AND LAKE WASHINGTON BECAME EUTHROPHIC. THE METRO ACT ENACTED IN 1957 PROVIDED FOR THE ESTABLISHMENT OF A METROPOLITAN MUNICIPAL CORPORATION WITH THE POWER TO PERFORM SEWAGE DISPOSAL, WATER, PARKS, TRANSPORTATION, COMPREHENSIVE PLANNING AND/OR GARBAGE DISPOSAL. IN 1958 THE SEWAGE DISPOSAL PROVISO WAS APPROVED BY 60% VOTE. JULY 1966 SHOULD SEE THE END OF SEWAGE DISCHARGE INTO LAKE WASHINGTON. $120 MILLION IN REVENUE BONDS HAVE BEEN SOLD TO DATE, TO BE REPAID BY A $2 MONTHLY CHARGE PER RESIDENTIAL CONNECTION AND A $2 MONTHLY CHARGE PER 900 CUBIC FEET OF WATER USED BY INDUSTRIAL AND COMMERICAL ENTERPRISES. PROMPT IMPROVEMENT IN THE LAKE IS EXPECTED WITHIN A FEW YEARS AFTER FINAL DIVERSION IN 1966 AS THE WATERSHED IS RELATIVELY POOR IN DISSOLVED MINERALS INCLUDING NUTRIENTS NEEDED BY ALGAE, AND AS THERE ARE NO MASSIVE DEPOSITS OF ACCUMULATED SOFT SEDIMENTS ON THE LAKE BOTTOM RICH IN NUTRIENTS AVAILABLE TO ALGAE, THE PROGNOSIS IS GOOD FOR THE RECOVERY OF LAKE WASHINGTON. (W70-04455).

00236. ECONOMICS AND POLITICS INFLUENCE POLLUTION ABATEMENT RESEARCH.

HEMWALL, J.B.

WATER AND SEWAGE WORKS, 116(6), 222-225, 1969.

MEETING THE RESEARCH NEEDS IN POLLUTION ABATEMENT, WHILE NECESSARY, IS FAR FROM SUFFICIENT TO GET ANYTHING ACCOMPLISHED. THE LITERATURE CONTAINS REFERENCES TO UNMET RESEARCH NEEDS AND ADDITIONAL INFORMATION IS AVAILABLE FROM THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. THIS DISCUSSION, HOWEVER, IS ADDRESSED MAINLY TO THE INFLUENCES WHICH MAKE POLLUTION ABATEMENT RESEARCH INSUFFICIENT--NAMELY, ECONOMICS, POLITICS AND SOCIAL HABITS. THE AUTHOR STATES THAT THE OUTSTANDING ECONOMIC CHARACTERISTIC OF WATER IS THAT IT HAS NO VALUE. ITS PRICE IS QUITE ARBITRARY AND THERE IS A GREAT DEAL OF FEDERAL ACTIVITY THAT CAN BE CONSIDERED A SUBSIDY. THE ECONOMICS OF WATER IS EVEN WORSE AFTER THE WATER HAS BEEN USED. INITIALLY, PAYMENT HAS TO BE MADE FOR THE COST OF TRANSPORTATION, FOR WHATEVER TREATMENT IS PERFORMED, AND FOR THE OPERATION OF THE SYSTEM. THESE ITEMS ESTABLISH A COST, IF NOT A VALUE. USED WATER HAS NEITHER VALUE NOR COST AND THERE IS NO ECONMIC INCENTIVE TO CLEAN IT UP. SUGGESTIONS ARE OFFERED THAT COULD IMPROVE THE ECONOMICS OF WATER IN THIS AREA. OTHER PROBLEMS OF WATER POLLUTION ABATEMENT IN THE AREAS OF POLITICS AND UNMET NEEDS ARE DISCUSSED. (W70-04518).

00237. PHYSICAL AND ENGINEERING ASPECTS OF THERMAL POLLUTION.

PARKER, F.L.; KRENKEL, P.A.; STEVENS, D.B.

CRC CRITICAL REVIEWS IN ENVIRONMENTAL CONTROL, 1(1), P 101-192, FEBRUARY 1970. 92 P.

THE RATE OF GROWTH OF COOLING WATER REQUIREMENTS WITH PARTICULAR REFERENCE TO CENTRAL ELECTRICITY GENERATING STATIONS, THE POSSIBILITIES OF IMPROVED EFFICIENCIES IN ELECTRICITY PRODUC-

TION, THE LIMITED AVAILABILITY OF COOLING WATER AND THE MECHANISMS AND MEANS OF HEAT DISSIPATION ARE DETAILED. ALSO DESCRIBED ARE THE EFFECTS OF HEATED DISCHARGES UPON THE BIOTA AND THE HYDRODYNAMICS OF THE RECEIVING WATERS. IT HAS BEEN SHOWN THAT NEW PLANT SIZES WILL BE SUCH THAT ONLY IN A FEW AREAS OF THE COUNTRY WILL WE BE ABLE TO MEET BIOLOGICALLY DERIVED STANDARDS IF RUN OF THE RIVER COOLING IS USED. IT HAS ALSO BEEN SHOWN THAT EXPECTATIONS OF INCREASED FLOW OR REDUCED COOLING REQUIREMENTS DUE TO INCREASED THERMAL EFFICIENCIES ARE NOT LIKELY TO BE REALIZED. WE CANNOT EXPECT TO FIND SUFFICIENT BENEFICIAL USES OF THE DEGRADED HEAT TO SUBSTANTIALLY DIMINISH THE PROBLEM. THE CHOICE WILL BE WHETHER TO PAY THE PRICE FOR PREVENTING THE EXCESS HEATING OF OUR SURFACE WATERS OR TO ACCEPT THE CONSEQUENCES OF DISCHARGING THESE HEATED EFFLUENTS AND LET THEM TAKE THEIR TOLL. A BIBLIOGRAPHY OF 423 ENTRIES IS INCLUDED. (W70-05059).

00238. MINE DRAINAGE IN THE NORTH BRANCH POTOMAC RIVER BASIN.

CLARK, L.J.

CHESAPEAKE TECHNICAL SUPPORT LABORATORY TECHNICAL REPORT NO 13, FEDERAL WATER POLLUTION CONROL ADMIN, MIDDLE ATLANTIC REG, AUGUST 1969. 87 P.

WATER QUALITY AND MINE DRAINAGE POLLUTION OF THE NORTH BRANCH POTOMAC RIVER ARE SURVEYED. FOR OVER A CENTURY, MINE DRAINAGE HAS BEEN THE PRIMARY CAUSE OF DEGRADATION IN THE BASIN. MORE THAN 40 MILES OF THE MAIN STEM ABOVE LUKE, MARYLAND, AND OVER 100 MILES OF TRIBUTARY STREAMS ARE NOW VIRTUALLY DEVOID OF AQUATIC LIFE BECAUSE OF THE EFFECTS OF MINE DRAINAGE. THE PRINCIPAL CONSTITUENTS OF MINE DRAINAGE ARE TOTAL DISSOLVED AND SUSPENDED SOLIDS, ACID, IRON AND MANGANESE, AND TOXIC PRECIPITATES. AN ESTIMATED 79,000 LBS/DAY OF ACIDITY IS CONTRIBUTED BY STREAMS WITHIN THE STATE OF WEST VIRGINIA AND 39,000 LBS/DAY BY STREAMS WITHIN THE STATE OF MARYLAND. ACTIVE COAL MINES IN WEST VIRGINIA APPEAR TO BE A SIGNIFICANT, AND PERHAPS THE LARGEST, SOURCE OF ACID MINE DRAINAGE WHILE IN MARYLAND, DRAINAGE FROM INACTIVE MINES APPEARS TO BE THE MOST SIGNIFICANT SOURCE. A PRELIMINARY ESTIMATE OF ANNUAL EXPENDITURES REQUIRED TO PROVIDE NECESSARY PREVENTION, COLLECTION, AND TREATMENT MEASURES IN THE SEVEN MOST CRITICAL WATERSHEDS OF THE POTOMAC BASIN IS $5,000,000. CAPITAL COSTS ARE ESTIMATED AT $32,500,000. (W70-05176).

00239. EFFECT OF STARCH SUBSTITUTES ON TEXTILE WASTES.

MCCARTHY, J.A.

SANITALK, 4(1), P23-25, 1955.

THE EXTENSIVE USE OF STARCH IN THE PROCESSING OF TEXTILES, THE PROCESSES INVOLVED, AND THE HIGH BOD OF TEXTILE WASTE WATERS RESULTING FROM ITS USE ARE OUTLINED INVESTIGATIONS MADE AT THE LAWRENCE EXPERIMENT STATION, MASSACHUSETTS, ON THE BOD OF STARCH SOLUTIONS AND SOLUTIONS OF STARCH SUBSTITUTES MADE UP TO 0.1% SOLUTIONS, AS USED IN TEXTILE MILLS, SHOWED THAT WHEREAS THE BOD OF STARCH SOLUTIONS AVERAGED FROM 600 TO 1000 PPM, FIGURES FOR SUBSTITUTES WERE CONSIDERABLY LOWER, AND THAT IN MIXTURES OF STARCH AND CMC EXERTION OF THE BOD WAS RETARDED. THE EFFICIENCY OF TREATMENT OF STARCH AND CMC MIXTURES ON PERCOLATING FILTERS WAS ALSO STUDIED. IT WAS CONCLUDED THAT A REDUCTION IN THE BOD OF TEXTILE WASTE COULD BE EFFECTED BY THE USE OF STARCH SUBSTITUTES, GIVING A REDUCTION IN THE POLLUTIONAL LOAD DISCHARGE TO STREAMS AND A REDUCTION IN THE COST OF TEXTILE WASTE TREATMENT. (W70-05156).

00240. CONVENTIONAL AND ADVANCED WASTE TREATMENT.

PARKHURST, J.D.

REPORT NO. 16, UNIV. OF CALIF., LOS ANGELES, CALIF. WATER RESOURCES CENTER, P. 16-28, DEC. 1969. 13 P.

WASTE WATER IS GENERATED WITHIN LOS ANGELES COUNTY AT THE RATE OF 700 MILLION GALLONS PER DAY. THIS WASTE WATER IS AN UNTAPPED SUPPLY OF ADDITIONAL WATER. WATER RECLAMATION AND REUSE HAS BEEN CONTINUING SINCE 1949. DIRECT RECHARGE OF GROUNDWATER BASINS BY SPREADING HAS BEEN OCCURRING AS A NATURAL ADJUNCT OF WATER TREATMENT FOR MANY YEARS. SUCH TREATMENT OF EFFLUENT MEETS HEALTH REQUIREMENTS. THE SANITATION DISTRICTS' MASTER PLAN IS PRESENTED. ADVANCED WASTE TREATMENT, OR TERTIARY TREATMENT, STARTS WITH SECONDARY EFFLUENT AND IMPROVES OR TAILORS THE QUALITY OF THE WATER FOR SOME SPECIFIC PURPOSE. TWO FORMS OF SECONDARY EFFLUENT REMOVAL ARE FILTRATION AND MICROSTRAINING. DIFFERENT METHODS OF THE REMOVAL OF NUTRIENTS, SUCH AS PHOSPHATE, AMMONIA AND NITRATE, ARE GIVEN. OTHER ASPECTS OF SECONDARY WATER TREATMENT DISCUSSED ARE CARBON ABSORPTION, DEMINERALIZATION, REVERSE OSMOSIS, ION EXCHANGE, AND ELETRODIALYSIS. DATA ON WATER QUALITY CHARACTERISTICS THAT RESULTS FROM DEMINERALIZATION PROCESSES ARE PRESENTED. (W70-05277).

00241. THE CONSTITUTIONALITY OF EFFLUENT CHARGES (EFFLUENT CHARGES--DEFINITION).

LYMAN, S.R.

THE CONSTITUTIONALITY OF EFFLUENT CHARGES, UNIV OF WIS WATER RESOURCES CENTE, P 1-21, MAY 1969. 21 P.

THE CONTINUAL PRODUCTION OF EXCESSIVE WASTE THREATENS TO EXHAUST OUR AVAILABLE WATER SUPPLY, AND THE DEMAND FOR USABLE WATER IS CONSTANTLY INCREASING. THE EFFFLUENT CHARGE IS AN ECONOMIC INCENTIVE TECHNIQUE FOR IMPLEMENTING WATER QUALITY STANDARDS. IT IS A MONETARY LEVY IMPOSED ON ANYONE WHO CONTRIBUTES TO WATER POLLUTION BY DISCHARGING WASTE AND IS COMPUTED ON THE BASIS OF THE QUANTITY AND QUALITY OF THE WASTE SO DISCHARGED. THE BASIC PRINCIPLE IS TO REQUIRE THE PRODUCER OF WASTE TO PAY ALL COSTS ASSOCIATED THEREWITH. THE EFFLUENT CHARGE WOULD YIELD SUBSTANTIAL REVENUE, WHICH COULD BE USED TO FINANCE ADMINISTRATION AND COSTS OF WATER QUALITY CONTROL IN RIVER BASIN. THIS CHARGE IS SOMEWHAT SIMILAR TO SEWER TAXES AND CHARGES AHD HIGHWAY-USE TAXES, ALTHOUGH THERE ARE IMPORTANT DIFFERENCES WHICH MAY AFFECT CONSTITUTIONALITY. THERE HAVE NEVER BEEN ANY EFFLUENT CHARGES IN THIS COUNTRY, ALTHOUGH THEY HAVE BEEN USED IN EUROPE TO GOOD EFFECT. HOWEVER, THERE IS A RISING INTEREST IN EFFLUENT CHARGES. THE MAIN QUESTION DEALT WITH IS WHETHER SUCH SYSTEM WOULD WITHSTAND CONSTITUTIONAL CHALLENGE. WATER CLASSIFICATION IS DISCUSSED. (W70-05321).

00242. THE CONSTITUTIONALITY OF EFFLUENT CHARGES (THE WASTE DISCHARGER--THE POLICE POWER).

LYMAN, S.R.
THE CONSTITUTIONALITY OF EFFLUENT CHARGES, UNIV OF WIS WATER RESOURCES CENTER, P 22-52, MAY 1969. 30 P.

A POLLUTER AGAINST WHOM AN EFFLUENT CHARGE IS LEVIED COULD ALLEGE THAT SUCH CHARGE CONSTITUTED A TAKING OF PRIVATE PROPERTY WITHOUT JUST COMPENSATION, AND WAS THUS UNCONSTITUTIONAL. THIS CLAIM WOULD NECESSARILY BE BASED ON ALLEGED VESTED, PRIVATE PROPERTY RIGHTS. HOWEVER, SUCH RIGHTS MAY BE REGULATED BY THE STATE UNDER ITS POLICE POWER AS LONG AS THE REGULATION IS CALCULATED TO FURTHER PUBLIC HEALTH, SAFETY, WELFARE, OR MORALS, AND BEARS A REASONABLE RELATION TO THE PURPOSE OF THE REGULATION. OBVIOUSLY, POLLUTION CONTROL AND ABATEMENT IS A PROPER LEGISLATIVE PURPOSE. THE EFFLUENT CHARGE BEARS A REASONABLE RELATION TO THIS PURPOSE IN THAT IT IS DIRECTED TOWARD THE CAUSE OF POLLUTION AND IS DESIGNED TO REDUCE THAT CAUSE. COURTS GENERALLY ACCEPT THE LEGISLATURE'S JUDGMENT ON THE 'REASONABLE RELATION' ISSUE IN THE ABSENCE OF EXTRMEME CIRCUMSTANCES. THE EFFLUENT CHARGE SYSTEM IS NOT ARBITRARY IN THAT IT HAS A RATIONAL BASIS FOR ITS EXISTENCE. EFFLUENT CHARGES ARE NOT DISCRIMINATORY EVEN THOUGH DIFFERENCT POLLUTERS WOULD BE CHARGED AT DIFFERENT RATES. THE CHARGE IS BASED ON THE AMOUNT OF DAMAGE DONE BY EACH UNIT OF WASTE DISCHARGED. ALTHOUGH THIS WILL VARY WITH THE DIFFERENT HYDROLOGIC CHARACTERISTICS OF THE WATER, IT IS NOT DISCRIMINATORY. (W70-05322).

00243. THE CONSTITUTIONALITY OF EFFLUENT CHARGES (THE WASTE DISCHARGER--EMINENT DOMAIN).

LYMAN, S.R.
THE CONSTITUTIONALITY OF EFFLUENT CHARGES, UNIV OF WIS WATER RESOURCES CENTER, P 53-59, MAY 1969. 7 P.

ANOTHER ARGUMENT THAT MIGHT BE RAISED AGAINST EFFLUENT CHARGES BY POLLUTERS IS THAT THE EFFLUENT CHARGE SYSTEM IS A 'TAKING' OF RIGHTS, THUS FALLING UNDER THE STATE'S POWER OF EMINENT DOMAIN AND REQUIRING THE PAYMENT OF JUST COMPENSATION. HOWEVER, COURTS HAVE GENERALLY HELD THAT REGULATIONS MAY CAUSE ECONOMIC LOSSES TO A MEMBER OF THE REGULATED CLASS, OR EVEN PROHIBIT A CERTAIN USE OF PROPERTY ALTOGETHER AND STILL NOT CONSTITUTE A TAKING FOR WHICH COMPENSATION MUST BE PAID. THE REGULATION MAY STILL BE VALID UNDER THE POLICE POWER. WATER POLLUTION CONTROL MEASURES HAVE USUALLY BEEN CONSIDERED POLICE POWER REGULATIONS. FURTHER, ANY 'RIGHT TO POLLUTE' WHICH MAY EXIST IS NOT SEPARATE PROPERTY BUT MERELY A 'USE' WHICH MAY BE PROHIBITED WITHOUT THE PAYMENT OF COMPSENSATION. THIS RESTRAINT ON THE USE OF WATER WOULD NOT AMOUNT TO A SUBSTANTIAL DEPRIVATION OF ALL THE USES OF WATER, AND ANY HARM THEREFROM WOULD BE OUTWEIGHED BY THE COLLECTIVE BENEFIT. (W70-05323.

00244. THE CONSTITUTIONALITY OF EFFLUENT CHARGES (THE WASTE DISCHARGER-UNLAWFUL DELEGATION).

LYMAN, S.R.
THE CONSTITUTIONALITY OF EFFLUENT CHARGES, UNIV OF WIS WATER RESOURCES CENTER, P 60-73, MAY 1969. 14 P.

A WASTE DISHCARGER MAY ARGUE THAT PLACING ADMINISTRATIVE RESPONSIBILITY FOR AN EFFLUENT-CHARGE SYSTEM INTO THE HANDS OF A PUBLIC AGENCY AMOUNTS TO AN UNLAWFUL DELEGATION OF LEGISLATIVE AND JUDICIAL POWER. THE AGENCY WOULD BE EMPOWERED TO SET RATES TO BE CHARGED UPON EACH UNIT OF WASTE, WHICH WOULD VARY ACCORDING TO MANY FACTORS, AND TO ASSESS AND COLLECT EACH POLLUTER'S ASSESSED CHARGE. IN ALL STATES, ADMINISTRATIVE AGENCIES WITH VARYING POWERS AND DUTIES, HANDLE WATER POLLUTION CONTROL AND ABATEMENT REGULATION. GENERALLY, COURTS HAVE HELD THAT, IF SUFFICEINTLY CLEAR GUIDELINES FOR ACTION ARE LAID DOWN, LEGISLATURES MAY DELEGATE THE REASONABLE AUTHORITY NECESSARY TO ACCOMPLISH DESIRED CONSTITUTIONAL PURPOSES. A SETTING FORTH IN REASONABLY SPECIFIC TERMS OF AGENCY POWERS AND RESPONSIBILITIES SHOULD AVOID ANY QUESTION, ON THESE GROUNDS, AS TO THE CONSTITUTIONALITY OF EFFLUENT CHARGES. (W70-05324).

00245. THE CONSTITUTIONALITY OF EFFLUENT CHARGES (THE WASTE DISCHARGER--THE TAX POWER).

LYMAN, S.R.
THE CONSTITUTIONALITY OF EFFLUENT CHARGES, UNIV OF WIS WATER RESOURCES CENTER, P 74-99, MAY 1969. 26 P.

WASTE DISCHARGERS MAY CONTEND THAT EFFLUENT CHARGES CONSTITUTE AN UNCONSTITUTIONAL TAX. HOWEVER, IT CAN BE ARGUED THAT EFFLUENT-CHARGE SYSTEMS ARE REGULATORY MEASURES, WITH CHARGES BEING FEES RATHER THAN TAXES. IF THE PURPOSE OF AN ENACTMENT IS FOR REGULATION RATHER THAN REVENUE, THE MEASURE FALLS UNDER THE POLICE POWER. FEES COLLECTED UNDER AN EFFLUENT-CHARGE SYSTEM SHOULD BE REASONABLY RELATED TO THE COSTS OF ADMINISTERING THE PROGRAM AND ABATING THE POLLUTION. AS LONG AS IT IS REASONABLE THE SIZE OF THE FEE WOULD NOT DETRACT FROM ITS VALIDITY AS A POLICE-POWER MEASURE, NOR CAUSE IT TO BECOME A TAX. THE PURPOSE OF THE EFFLUENT CHARGE IS PRIMARILY REGULATORY. IT IS DESIGNED TO CONTROL AND ABATE POLLUTION OF A STATE'S WATERS AND TO BENEFIT THE HEALTH, SAFETY, AND WELFARE OF THE PEOPLE OF THE STATE. IT IS CLEARLY AN EXERCISE OF THE POLICE POWER. AS SUCH, THE MEASURE NEED NOT COMPLY WITH STATE CONSTITUTIONAL PROVISIONS REQUIRING EQUALITY AND UNIFORMITY, AND IT DOES NOT OFFEND THE EQUAL PROTECTION CLAUSE OF THE FEDERAL CONSTITUTION. EVEN IF THE EFFLUENT CHARGE IS CONSIDERED A TAX, IT IS CONSTITUTIONAL. (W70-05325).

00246. FRITZ V BD OF TRUSTEES (ASSESSMENTS FOR CONSTRUCTION OF A SANITARY SEWER SYSTEM).

252 NE2D 567-572 (IND 1969).

TRUSTEES OF APPELLEE TOWN RESOLVED TO INSTALL WITHIN THE TOWN A SANITARY SEWER SYSTEM. THE RESOLUTION PROVIDED FOR ASSESSMENT OF ALL PRO-

PERTY WITHIN THE TOWN TO PAY FOR CONSTRUCTION OF THE SYSTEM. PROVISION WAS MADE FOR A PUBLIC HEARING TO FINALIZE THE RESOLUTION AND ALLOW REMONSTRANCES IN OPPOSITION TO THE PLAN. NOTICE OF THE HEARING WAS POSTED IN FIVE LOCATIONS. NO REMONSTRANCES WERE FILED AND THE TRUSTEES CONFIRMED THE RESOLUTION AND ASSESSED APPELLANT'S PROPERTY. APPELANTS BROUGHT ACTION TO ENJOIN THE ENFORCEMENT OF THE ASSESSMENT. THE TRIAL COURT UPHELD THE TRUSTEES ACTIONS. THE SUPREME COURT, IN REVERSING, HELD THAT APPELANTS WERE DEPRIVED OF DUE PROCESS OF LAW BY THE FAILURE OF APPELLEES TO GIVE ADQUATE NOTICE OF THE SEWER ASSESSMENT PROCEEDINGS. IT WAS UNCONTRADICTED THAT APPELANTS RECEIVED NO ACTUAL NOTICE OF THE HEARINGS. A PROPERTY OWNER SHOULD NOT BE FORCED TO CONTINUALLY SEARCH PUBLIC RECORDS FOR NOTICE OF PROCEEDINGS AFFECTING HIS PROPERTY. WHEN ASSESSMENT PROCEEDINGS AFFECT SPECIFIC PROPERTY, NOTICE SHOULD BE GIVEN IN A MANNER CALCULATED TO PROVIDE ACTUAL NOTICE TO AFFECTED INDIVIDUALS (W70-05366).

00247. NUTRIENT REMOVAL A UNIVERSAL REQUIREMENT.

DAVIES, R.
WATER AND POLLUTION CONTROL, P 28-30, JANUARY 1970.

THIS REVIEW OF THE INTERNATIONAL JOINT COMMISSION FINDINGS ON POLLUTION OF LAKES ERIE AND ONTARIO AND THE ST LAWRENCE RIVER INTERNATIONAL SECTION RECOMMENDSAL REPLACEMENT OF PHOSPHATES IN DETERGENTS IS POSSIBLE WITH NO REDUCTION IN CLEA COMPLETE REPLACEMENT OF PHOSPHORUS COMPOUNDS IN DETERGENTS AND PHOSPHORUS REDUCTION IN MUNICIPAL AND INDUSTRIAL WASTES WITH NITROGEN REDUCTION TO FOLLOW. PARTINSING EFFICIENCY. AN ENVIRONMENTALLY HARMLESS SUBSTITUES FOR FULL REPLACEMENT OF PHOSPHATES MIGHT BE FOUND. IF PHOSPHATES WERE REPLACED IN DETERGENTS, REMOVAL OF 80% OF REMAINING PHOSPHORUS AT SEWAGE TREATMENT PLANTS WOULD REDUCE THE CONCENTRATION TO 0.6 MILLIGRAMS/LITER. FURTHER REDUCTION IN LAKES ARE POSSIBLE BY PREVENTING LAND DRAINAGE. ANTIPOLLUTION RECOMMENDATIONS INCLUDE: STANDBY EQUIPMENT TO TAKE OVER DURING BREAKDOWNS, INADEQUATE PERFORMANCE, OR OVERFLOW; SEPARATION OF STORM AND SANITARY SEWAGE COLLECTION SYSTEMS; AVOIDANCE OF BYPASSING UNTREATED WASTES; INTENSIFICATION OF VIRAL RESEARCH; REQUIREMENT THAT ORGANIZATION PLANNING THERMAL POWERPLANTS SUBMIT PLAN TO POLLUTION CONTROL AGENCIES; BANNING UNCONFINED OPEN LAKE DUMPING; IMPLEMENTATION OF HERBICIDES AND PESTICIDES CONTROLS; RECOGNITION THAT OIL AND GAS DRILLING ARE POTENTIAL POLLUTION SOURCES; MAINTENANCE OF ADEQUATE WATER QUALITY MONITORING. SUCCESS OF THE PROPOSALS DEPENDS UPON WILLINGNESS OF THE PUBLIC TO PAY INCREASED CONTROL COSTS. (W70-05412).

00248. WASTE WATER RECIRCULATION AS A MEANS OF RIVER POLLUTION ABATEMENT.

BLANKENBACH, W.W.; WILLLISON, W.A.
JOURNAL OF THE AMERICAN SOCIETY OF SUGAR BEET TECHNOLOGISTS, 15(5), 396-402, 1969.

A SUCCESSFUL PROJECT BY MANITOBA SUGAR COMPANY, FORT GARRY, MANITOBA, TO REDUCE RIVER POLLUTION BY ELIMINATING SUGAR BEET PROCESSING WASTES IS DESCRIBED. THE COMPANY'S SEWAGE CHARGES EXCEEDED $64,000 PER YEAR EXERTING ECONOMIC PRESSURE TO REDUCE ITS POLLUTION LOAD. A RECIRCULATION SYSTEM WAS PUT INTO OPERATION IN 1965. TRAVELING AND VIBRATING SCREENS REMOVE LARGER ORGANIC MATERIAL. A CLARIFIER REMOVES PARTICULATE MATTER AND SUSPENDED SOLIDS. LIME IS ADDED AT THE CLARIFIER TO RAISE THE PH TO 11.5 0 TO IMPROVE COAGULATION AND SEDIMENTATION. THE CLARIFIER OVERFLOW IS RECIRCULATED TO THE FLUME WATER SUPPLY TANK AND THE UNDERFLOW IS PUMPED TO MUD SETTLING PONDS. CLEAN WATER IS COLLECTED IN A COLLECTOR DITCH AND RETURNED TO THE CLARIFIER. THE INSTALLED COST OF THE SYSTEM, EXCLUDING SCREENS, AMOUNTED TO APPROXIMATELY $300,000. OPERATING EXPENSE IS LIMITED TO LIME ADDITION (1.5-4.5 TONS PER DAY). CONCENTRATION OF DISSOLVED SOLIDS IN THE RECIRCULATING WATER BUILDS STEADILY, BUT LEVELS OUT AT ABOUT 10,000 PPM OF TOTAL DISSOLVED SOLIDS AND 6000 PPM BIOCHEMICAL OXYGEN DEMAND. THE INCREASED CONCENTRATION OF DISSOLVED SOLIDS IN THE RECIRCULATING SYSTEM IS FELT TO PRODUCE SIGNIFICANT SAVINGS OF SUGAR BY REDUCING OSMOTIC PRESSURE DIFFERENTIALS. THE SOIL IN THE SLUDGE BED APPARETLY IS STABILIZED AND NO PROBLEM IS EXPECTED IN DISPOSING OF THE DRY SLUDGE. (W70-05551).

00249. FOAM FRACTIONATION.

BRUNNER, C.A.; STEPHAN, D.G.
INDUSTRIAL AND ENGINEERING CHEMISTRY, P 40-48, MAY 1965.

THE SCOPE OF A RESEARCH EFFORT TO APPLY FOAM FRACTIONATION THEORY TO REMOVE SURFACTANTS FROM MUNICIPAL WASTE STREAMS AND A PRACTICAL DESIGN APPROACH TO ELIMINATE CHEMICAL OXYGEN DEMAND (COD) AND ALKYL BENZENE SULFONATE (ABS) ARE PRESENTED. CONTINUOUS RUNS ON MUNICIPAL EFFLUENTS FROM SEVEN TREATMENT PLANTS WERE CARRIED OUT IN LABORATORY-SCALE GLASS FOAM FRACTIONATION COLUMNS. THE COD AND METHYLENE BLUE DETECTABLE ABS CONCENTRATIONS WERE DETERMINED IN THE FEED, IN THE BOTTOM PRODUCT, AND FOR SOME SAMPLES IN THE COLLAPSED FOAM. THE FRACTION REMOVED FOR PRIMARY EFFLUENTS FOR COD AND ABS WERE 24% AND 50%. FOR SECONDARY EFFLUENTS, COD AND ABS REMOVALS WERE 25% AND 70%. DATA WERE COLLECTED FROM A PILOT-SCALE FOAM SEPARATOR IN POMONA, CALIFORNIA, OVER A 5-MONTH PERIOD. AT A GAS TO LIQUID FEED RATE GREATER THAN 5, ABOUT 35% OF THE GROSS ORGANIC CONTAMINANTS WERE REMOVED. SUSPENDED SOLIDS AND ABS EACH CONTRIBUTED ABOUT 40% OF THE TOTAL COD REMOVED AND THEREFORE ROUGHLY 20% OF THE TOTAL ORGANIC MATERIAL SEPARATED WAS SOLUBLE NON-ABS ORGANICS. AN AVERAGE ABS REMOVAL OF ABOUT 70% CAN BE EXPECTED. THE ADDITION OF SELECTED CATIONIC POLYELECTROLYTES TO THE FEED CAN IMPROVE REMOVALS. A SUMMARY OF TYPICAL CAPITAL AND OPERATING COSTS FOR FOAM SEPARATORS IS GIVEN. (W70-05562).

00250. THE CHEMICAL CONTROL OF AQUATIC NUISANCES.

MACKENTHUN, K.M.
COMMITTEE ON WATER POLLUTION, MADISON, WISCONSIN, JANUARY 1958. 64 P.

A DETAILED DESCRIPTION OF METHODS OF CONTROL OF AQUATIC ROOTED VEGETATION, ALGAE, AND CERCARIAE, CAUSING SWIMMERS' ITCH, IS GIVEN. THE BIOMASS OF AQUATIC WEEDS WAS REDUCED BY SODIUM ARSENITE TREATMENTS IN SOME 80 LAKES WITH AN APPROXIMATE APPLICATION EFFICIENCY OF 150 GALLONS OF HERBICIDE PER HOUR. ONE OR MORE ALGAE-ERADICATING TREATMENTS WERE GIVEN TO ABOUT 40 LAKES, AN APPLICA-

TION OF 250 POUNDS OF COMMERCIAL COPPER SULFATE CONSUMING ONE HOUR. CONTROL OF CERCARIAE WAS SUCCESSFUL IN A LIMITED NUMBER OF LAKES WITH A MIXTURE OF COPPER SULFATE AND COPPER CARBONATE. THE EFFICIENCY OF CONTROL MEASURES WAS MATERIALLY AUGMENTED BY THE USE OF SPECIALLY DESIGNED EQUIPMENT, INCLUDING STEEL BARGES, PORTABLE ALUMINUM ALLOY BARGES, SPRAY BOATS AND ASSEMBLIES, LOADING BOOMS, AND GRAVITY FLOW INJECTORS. (W70-05568).

00251. SYSTEM ANALYSIS AND ITS APPLICATION TO RIVER BASIN POLLUTION CONTROL MANANGEMENT.

CHAUDHURI, N.
INSTITUTION OF ENGINEERS (INDIA) JOURNAL, PUBLIC HEALTH ENG DIV, 49(10), 118-124, 1969.

THE PAPER INTRODUCED THE POSSIBILITY OF APPLICATION OF SYSTEMS ANALYSIS AS A TOOL FOR SOLVING MANAGMENT PROBLEMS OF RIVER POLLUTION FOR AN ENTIRE BASIN. THEPOLLUTION CONTROL PROBLEM WAS SHOWN AS A LINEAR PROGRAMMING MODEL AND THE CHARACTERISTICS OF ITS SOLUTION WERE ILLUSTRATED GRAPHICALLY. A HYPOTHETICAL RIVER BASIN INCLUDING LOCATIONS OF WASTEWATER TREAMENT PLANTS WAS USED AS AN EXAMPLE. THE PROBLEM WAS TO ESTIMATE AN OPTIMAL COMBINATION OF TREATMENT EFFICIENCIES AT TWO PLANTS SO THAT TOTAL COST OF TREATMENT WAS MINIMIZED AND AT THE SAME TIME THE MINIMUM DISSOLVED OXYGEN CONTENT WAS MAINTAINED IN THE RIVER. FOR THE NUMERICAL SOLUTION OF THE HYPOTHEICAL RIVER BASIN, THE ASSUMED VALUE FOR VARIOUS RATE CONSTANTS, DISTANCES, COST EQUATION CONSTANTS, PLANT DISCHARGES, BOD VALUES OF WASTES COMING TO THE PLANTS, DISSOLVED OXYGEN CONTENTS OF EFFLUENTS DISCHARGE AND OTHER VALUES RELATED TO THE RIVER WERE GIVEN. (W70-05769)

00252. SYSTEM OPTIMIZATION OF WASTE TREATMENT PLANT PROCESS DESIGN.

SHIH, C.S.; DEFILIPPI, J.A.
JOURNAL OF THE SANITARY ENGINEERING DIVISION, ASCE, 96(SA2) 409-421, 1970.

A METHODOLOGY OF ANALYSIS IS PRESENTED TO PRODUCE A GIVEN TREATMENT REQUIREMENT OF MINIMUM COST. THE METHODOLOGY INTEGRATES DYNAMIC PROGRAMMING TECHNIQUES INTO PRESENT DESIGN PRINCIPLES TO IDENTIFY THE OPTIMAL COMBINATION AND EFFICIENCIES OF VARIOUS UNIT PROCESSES IN A MULTI-STAGE PLANT. IN THIS CASE OPTIMAL IS DEFINED AS LEAST COST. AN ADVANTAGE TO THE MATHEMATICAL MODEL IS THAT IT CONSIDERS ALL UNIT PROCESSES AT THE SAME TIME FOR SYSTEM OPTIMIZATION IN CONTRAST TO THE MORE COMMON METHOD OF OPTIMIZING EACH UNIT PROCESS. AN ILLUSTRATIVE EXAMPLE IS USED IN WHICH THE COST OF A MUNICIPAL TREATMENT PLANT USING PRIMARY CLARIFICATION, SECONDARY TREATMENT (OPTION OF ACTIVATED SLUDGE OR TRICKLING FILTER) IS MINIMIZED AT $429,000. USING CONVENTIONAL DESIGN CRITERIA THE COST OF THE PLANT IS CALCULATED AT $450,900. COST CURVES ARE GIVEN FOR THE UNIT PROCESSES EMPLOYED IN THE PLANT AND THE POINT MADE THAT MORE RELIABLE INFORMATION CONCERNING THE COST AND PERFORMANCES OF UNIT PROCESSES IS NEEDED IN ORDER THAT TREATMENT SYSTEMS MAY BE MORE EFFECTIVELY OPTIMIZED. (W70-05800).

00253. ALTERNATIVE METHODS OF FINANCING WASTE TREATMENT FACILITIES.

LOPP, W.J. II.
J WATER POLLUTION CONTROL FED., 42(2), 291-297, 1970.

EXCEPT IN THE INITIAL YEAR (1966), THE FEDERAL GOVERNMENT HAS NOT FULFILLED ITS AUTHORIZATION FOR APPROPRIATION. GENERAL OBLIGATION BONDS, ISSUED BY LOCAL GOVERNMENTAL UNITS ARE USUSALLY RESTRICTED BY CONSTITUTIONAL, STATUTORY OR CHARTER DEBT CEILING, ETC, ALTERNATE FINANCING METHODS ARE PRESENTED TO REPLACE THE UNAPPROPRIATED FEDERAL AUTHORIZATION. THE PROPOSED ALTERNATES ARE: FIRST, FWPCA WOULD TRANSMIT REQUITIONS TO THE TREASURY DEPARTMENT WHICH WOULD BE FUNDED FROM THE SALE OF SECOND LIBERTY BONDS OR A SIMILAR DEBT INSTRUMENT. THE LIMIT WOULD BE THE DIFFERENCE BETWEEN AMOUNTS AUTHORIZED AND APPROPRIATED BY CONGRESS. THE SECOND IS THE ESTABLISHMENT OF TWO SEPARATE FINANCING VEHICLES TO HANDLE FEDERAL AND LOCAL GOVERNMENTAL SHARES OF THE COSTS. THE LOCAL GOVERNMENT WOULD ISSUE ITS OWN TAX-EXEMPT BONDS AND THE FEDERAL GOVERMENT WOULD THROUGH THE FWPCA SELL OBLIGATIONS WITH TAXABLE INTEREST INCOMES. THE THIRD PROPOSAL INVOLVES COMPLETE LOCAL FINANCING DURING CONSTRUCTION AND ESTABLISHMENT OF AN INDEPENDENT AGENCY TO ISSUE BONDS TO PROVIDE MONIES TO RETIRE A PORTION OF THE OUTSTANDING SHORT-TERM DEBT; THE BALANCE WOULD BE RETIRED FROM TAX-EMPT BONDS ISSUED BY THE LOCAL GOVERNMENTAL UNITS. TAX PROGRAMS AND FINANCING METHODS FOR INDUSTRIAL WASTE TREATMENT ENACTED AT STATE LEVELS ARE ALSO CITED. (W70-05804).

00254. ECONOMIC ASPECTS OF SEWAGE WORKS DESIGN.

CUPIT, J.V.
WATER POLLUTION CONTROL, 68(2), 166-177, 1969.

THE BASIC COSTS FACTOR ASSOCIATED WITH THE DESIGN OF A SEWAGE WORKS ARE DISCUSSED, AND THE APPLICATION OF THESE COST FACTORS TO THE DESIGN OF INDIVIDUAL UNITS IS CONSIDERED. THE CONCEPT OF TRUE COST IS DEFINED AS THE ANNUAL CHARGE RELATIVE TO A PARTICULAR UNIT, AND THE MAJOR COMPONENTS OF THE ANNUAL COST ARE DISCUSSED. THESE INCLUDE LOAN DEBT CHARGES; RENTS AND RATES, EMPLOYMENT OF LABOR; PURCHASE OF FUEL AND POWER; REPAIR AND MAINTENANCE OF PLANT, BUILDING AND MACHINERY, PLANT AND MACHINERY INSURANCE; MATERIAL PURCHASES, AND TRANSPORTATION. CONSIDERATION OF THE APPLICATION OF THE COST FACTORS INCLUDES DISCUSSION OF THE PUMPING PLANT, PRELIMINARY TREATMENT UNITS, BIOLOGICAL TREATMENT, TERTIARY TREATMENT, AND SLUDGE TREATMENT AND DISPOSAL. PARTICULAR EMPHASIS IS PLACED ON THE TOPICS OF SEDIMENTATION, BIOLOGICAL FILTERS, AND THE ACTIVATED-SLUDGE PROCESS. GENERAL ECONOMIC AND ENGINERRING PRINCIPLES SHOULD BE COMBINED WITH THE ENGINEER'S PERSONAL JUDGEMENT IN ORDER TO ACHIEVE A BALANCED SOLUTION OF THE DESIGN CONCEPT. (W70-05809).

REFERENCE LIST

00255. INCREASING WASTEWATER FLOW VELOCITY BY USING CHEMICAL ADDITIVES.

OVERFILE, J.L.; CRAWFORD, H.R.; BA[illegible]; HARRINGTON, L.J.; SANTRY, I.W. JR, .
J WATER POLLUTION CONTROL FED., 41(9), 1570-1585, 1969.

PRACTICAL METHODS HAVE BEEN DEVELOPED TO INCREASE WASTE WATER FLOW VELOCITY BY USING CHEMICAL ADDITIVES WITHOUT INCREASING THE ENERGY NEEDED TO MOVE THE LIQUID. EXISTING SEWER LINE FLOW CAN BE INCREASED BY USING POLYMER ADDITIVES THAT WOULD INCREASE THE SOLID REMOVAL EFFECTIVENESS AT TREATMENT PLANTS. A 100 FT LONG 6 IN SEWER LINE TEST FACILITY ALONG WITH 25,000-GAL CONTROLLED-TEMPERATURE RESERVOIR IS USED TO DETERMINE THE INCREASED WATER FLOW WITH ADDITION OF CHEMICAL ADDITIVES. THERE IS A RAPID INCREASE BY A FACTOR OF 2 OF MORE BY USING CONCENTRATIONS OF ADDITIVES BETWEEN 45 AND 200 ML/L. THE COST-BENEFIT ANALYSIS FOR A GIVEN EXAMPLE SHOWS THAT THE COST OF RECTIFYING OVERFLOW FROM A CONSTRICTION BY USING AN ADDITIVE INJECTION SYSTEM, IS LESS THAN HALF THE PRORATED COST OF CONTRUCTING A PARALLEL PIPE SYSTEM TO RELIEVE THE CONDITION. HOWEVER, IF THE OVERFLOWS OCCUR TEN TIMES A YEAR, THE ADDITIVE INJECTION SYSTEM BECOMES MORE EXPENSIVE. BIOCHEMICAL STUDIES CONDUCTED INDICATE THAT ADDITIVES DO NOT AFFECT ADVERSELY THE WASTE WATER, BACTERIA, FISH, OR PROMOTE ALGAE GROWTH. FURTHER, THE ADDITIVES IMPROVE WASTE WATER SETTLING AND SLUDGE DRYING RATES. ADDITIVES INJECTION SYSTEM, THOUGH PREFERABLE ECONOMICALLY IN MANY CASES, CANNOT BE APPLIED AS A LONG TERM SOLUTION. (W70-05819).

00256. TREATMENT OF TEXTILE WASTE LIQUORS.

LITTLE, A.H.
JOURNAL OF THE SOCIETY OF DYERS AND COLOURISTS, 83(7), 268-273, 1967.

THE CHARACTER OF TEXTILE WASTE LIQUORS AND METHODS THAT CAN BE EMPLOYED FOR THEIR PURIFICATIONS ARE DISCUSSED. ALTHOUGH THE EXAMPLES ARE BASED LARGELY ON COTTON PROCESSING, THE METHODS ARE APPLICABLE GENERALLY. THE NEED FOR MIXING AND BALANCING WASTE LIQUORS IS EMPHASIZED. METHODS OF BIOCHEMICAL TREATMENT ARE DESCRIBED WITH SOME INDICATION OF THE RELATIVE COSTS. THE METHOD USUALLY USED TO REMOVE SUSPENDED SOLIDS IS DESCRIBED BRIEFLY, AND THE EFFECTS OF OXIDIZING AND REDUCING SUBSTANCES ON THE BIOCHEMICAL TREATMENT ARE DISCUSSED. THE EASE OF TREATMENT OF EFFLUENTS CONTAINING SURFACE-ACTIVE AGENTS DEPENDS ON WHETHER THE AGENT IS 'HARD' OR 'SOFT', I. E., WHETHER THE AGENT HAS A HIGH OR LOW BOD. IF THE AGENT IS DISCHARGED TO A SEWER
MENT COSTS DEPENDS ON THE SIZE OF THE COMMUNITY IN WHICH THE WORKS IS SITUATED. THE RE-USE OF PART OF THE EFFLUENT FROM TEXTILE PROCESSES AND THE ANALYTICAL TESTS MADE ON THE EFFLUENT ARE DISCUSSED BRIEFLY. (W70-05863).

00257. WASTE LIQUORS FROM THE MERCERIZATION OF COTTON FABRICS AND LIMITING OF WASTE WATER ALKALINITY (IN CZECH).

JOSEK, J.
SUMMARIES IN ENGLISH, GERMAN, AND RUSSIAN, VODNI HOSPODARSTVI, 16(7), 288-291, 1966.

IN THE MERCERIZATION PROCESS, THE CONSUMPTION OF MERCERIZATION CAUSTIC DEPENDS MAINLY ON THE HUMIDITY OF THE FABRIC ENTERING AND LEAVING THE MERCERIZATION MACHINE. TO REDUCE THE CAUSTIC CONSUMPTION, INCREASED WRINGING BY THE MACHINE AND USE OF WASTE LIQUOR FOR THE DISSOLVING OF THE FRESH CAUSTIC ARE SUGGESTED. THE ECONOMICS OF THE NEUTRALIZATION OF THE WASTE LIQUOR BY H2SO4, JOL, FESO4. 7H20, AND C02 (FLUE GASES) AND THE SALT CONTENT OF THE NEUTRALIZED WASTE WATER ARE DISCUSSED. (W70-05865).

00258. IN SEARCH OF A CLEAR SOLUTION.

JENKINS, D.
SWEDEN NOW, 3(3), P 24-26, 44, 1969.

SOME OF SWEDEN'S WATER POLLUTION PROBLEMS CONSIST OF UNTREATED WASTE DISHCARGES INTO MANY OF ITS 100,000 LAKES, RENDERING THEM UNSUITABLE FOR RECREATION. THE POLLUTION SOURCES OF LAKE TRUMMEN WERE STOPPED, BUT THE LAKE WAS 'DEAD'--STRANGLED WITH PLANT GROWTH, AND A 16-FOOT SEDIMENT BLANKET. THE ATTEMPTED CURE WAS TO PUMP OUT THE TOP 20 INCHES OF SEDIMENT WHICH CONTAIN MOST OF THE POLLUTANTS. REMEDIAL ATTEMPTS IN OTHER PROJECTS ARE: DIRECT AERATION WITH AIR PUMPS, AERATION BY PUMPING BOTTOM WATER THROUGH AN ARTIFICIAL STREAM AND RETURNING IT TO THE BOTTOM, AND ALUMIUNUM SULPHATE TREATMENT, WHICH MIXES WITH PHOSPHORUS IN THE WATER, SETTLES TO THE BOTTOM, FORMING A HARMLESS BLANKET. REED MOWING IS BEING TRIED ON LAKE HORNBORGA, ITS LEVEL LOWERED TO PRODUCE ARABLE LAND BUT LEAVING THE LAKE SHALLOW, OVERGROWN, AND OXYGEN DEFICIENT. THE GOVERNMENT IS SUBSIDIZING WASTE TREATMENT PLANTS AT $8 MILLION ANNUAL RATE, AND SUBSIDIES FOR INDUSTRIAL POLLUTION CONTROL ARE PROPOSED WHICH WOULD COVER UP TO 25% OF THE CAPITAL COST. THE POLLUTION OF THE BALTIC SEA IS INCREASING AND BECOMING AN INTERNATIONAL CONCERN. (W70-05986).

00259. DEVELOPMENT OF TERTIARY TREATMENT METHODS FOR WASTE WATER RENOVATION.

ECKENFLEDER, W.W., JR.
WATER POLLUTION CONTROL, 68(5), 584-591, 1969.

A REVIEW OF VARIOUS TERTIARY TREATMENT METHODS AVAILABLE TO REMOVE POLLUTANTS NOT ORDINARILY REMOVED BY CONVENTIONAL TREATMENT PROCESSES IS PRESENTED. FILTRATION REMOVES SUSPENDED SOLIDS TO LESS THAN 3 MG/L. SOLUBLE COD HAS BEEN REDUCED TO 7 G/L USING ADSORPTION ON ACTIVATED CARBON . REMOVAL OF DISSOLVED ORGANICS MAY BE ACHIEVED BY ION EXCHANGE, ELECTRODIALYSIS, AND REVERSE OSMOSIS. NUTRIENTS ARE TREATED SEPARATELY. PHOSPHORUS REMOVALS ARE POSSIBLE BY PRECIPITATION IN PRIMARY SYSTEMS, (80-90%), PRECIPITATION IN AERATION TANKS, (50-92%), POST-PRECIPITATION (90%) AND LUXURY BIOLOGICAL UPTAKE (85-90%). STRIPPING, ION-EXCHANGE AND NITRIFICATION FOLLOWED BY DENITRIFICATION ARE DESCRIBED FOR NITROGEN REMOVAL. DATA ON ALL THE UNIT PROCESSES MENTIONED ARE GIVEN AS ARE COST FIGURES FOR: ADSORPTION, ION EXCHANGE, NITRIFICATION AND DENITRIFICATION, CHEMICAL TREATMENT, STRIPPING, SEPARATION

BEDS, CARBON ADSORPTION AND ELECTRODIALYSIS. OPERATING COSTS FOR 10 MGD PLANT UTILIZING PRIMARY CLARIFICATION, ACTIVATED SLUDGE, PHOSPHOROUS PRECIPITATION, NITRIFICATION-DENITRIFICATION, FILTRATION, AND CARBON ADSORPTION IS ESTIMATED TO BE 15 CENTS/1000 GALLONS. (W70-06049).

00260. TERTIARY FLOCCULATION AND FILTRATION.

TOSSEY, D.; FLEMING, P.J.; SCOTT, R.F.
ASCE J SANITARY ENGINEERING, 96(SA1), 1970.

THE CONVENTIONAL WATER TREATMENT PROCESSES OF FLOCCULATION, SEDIMENTATION, AND FILTRATION WERE STUDIED IN A 0.5 MGD PILOT PLANT TO DEMONSTRATE THEIR APPLICABILITY IN TERTIARY TREATMENT OF TRICKLING FILTER EFFLUENT. IT WAS DEMONSTRATED THAT SIGNIFICANT EFFLUENT QUALITY IMPROVEMENTS CAN BE MADE EMPLOYING THESE PROCESSES. LIME AND ALUM WERE USED AS PRIMARY COAGULANTS AND ACTIVATED SILICA, FERRIC SULFATE AND AN ORGANIC POLYELECTROLYTE WERE USED AS COAGULANT AIDS. OPTIMIZED TREATMENT SCHEMES AND CHEMICAL DOSAGES PRODUCED EFFLUENTS CONTAINING 4 MG/L BOD5,25 MG/L SUSPENDED SOLIDS, AND 5 MG/L PHOSPHATE. CAPITAL AND OPERATING COST ESTIMATES FOR A FULL-SCALE PLANT TREATING 75 MGD OF TRICKLING FILTER EFFLUENT RANGED FROM 37 CENTS/1000 GALLONS TO CENTS/1000 GALLONS DEPENDING UPON THE CHEMICALS EMPLOYED. (W70-06060).

00261. THE COST OF SEWAGE TREATMENT.

BRADLEY, RM.M.; ISSAC, P.C.G.
WATER POLLUTION CONTROL, 68(4), 368-402, 1969.

A BRIEF SURVEY OF CAPITAL AND OPERATING COSTS OF MUNICIPAL SEWAGE TREATMENT IN THE UNITED KINGDOM WAS PREPARED WITH DATA OBTAINED FROM 12 CONSULTING ENGINEERING FIRMS AND 34 TREATMENT WORKS. DIFFICULTY WAS EXPERIENCED IN OBTAINING COMPLTE DATA, PARTICULARLY IN OPERATING COSTS. THE CAPITAL COSTS SURVEY WAS BASED ON 79 WORKS, 40% SERVED POPULATIONS LESS THAN 5000 AND 80% SERVED POPULATIONS IN THE 10000 TO 50,000 RANGE. GRAPHS WERE PRODUCED BY A COMPUTER PROGRAM USING THE LEAST SQUARES METHOD TO PRESENT CAPITAL COST DATA OF TOTAL WORKS, COMPONENTS, AND ASSOCIATED COSTS AS FUNCTIONS OF POPULATION AND/OR CAPACITY. THE OPERATING COST DATA WAS OBTAINED FROM 34 TREATMENT WORKS SERVING POPULATIONS FROM 100 TO GREATER THAN 100,000; 54% SERVED POPULATIONS LESS THAN 10,000 AND 91% SERVED POPULATIONS LESS THAN 50,000. ANNUAL OPERATING COSTS, EXCLUDING DEBT COSTS AND WITH THESE COTS INCLUDED, ARE GRAPHICALLY PRESENTED FOR THE MOST EXTENSIVELY USED PROCESS, SINGLE FILTRATION, AS A FUNCTION OF POPULATION SERVED. A RELATIONSHIP BETWEEN ANNUAL OPERATING COSTS AND TOTAL CAPITAL COSTS AS A FUNCTION OF DEBT CHARGES, WAS DETERMINED AND PRESENTED GRAPHICALLY. THE AVERAGE ANNUAL OPERATING COST WAS APPROXIMATELY 3.1 % OF TOTAL CAPITAL COST. THE DEBT CHARGES REPRESENT APPROXIMATELY 69% OF TOTAL ANNUAL OPERATING COST. THE MAIN CONCLUSION DRAWN FROM THE SURVEY WAS THAT DATA AVAILABLE ARE INADEQUATE. (W70-06061).

00262. DITCHES PROVIDE EFFICIENT TREATMENT.

BURCHINAL, J.C.; JENKINS, C.R.
ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 3(11), 1170-1173, 1969.

AN EVALUATION OF AN OXIDATION DITCH AT CAMERON, W. VA. IS PRESENTED. THE PLANT WAS DESIGNED FOR A POPULATION OF 2400 AND FLOW OF 240,000 GPD. THE DITCH IS 620 FEET LONG, 4 FEET DEEP, 16 FEET TOP WIDTH AND 9 FEET BOTTOM WIDTH. TWO 8 FT 27 1/2 IN DIAMETER ROTORS OPERATE AT 75 RPM AND 6 IN SUBMERGENCE. THE AVERAGE RETENTION TIME IS 24 HOURS AND FLOW VELOCITY IS KEPT AT 1 FPS. DATA COLLECTED FROM SEPTEMBER 1965 - AUGUST 1967 SHOWED FLOW VARIATIONS BETWEEN 69,400 - 438,000 GPD. THE LATTER BEING INFLUENCED BY COMBINED STORM WATER FLOW. AT LOW FLOW EFFICIENCIES WERE: BOD 86-98%, SS 49-97%, ABS 74%. MAXIMUM MONTHLY AVERAGE SS IN DITCH WERE 9941 WHICH CORRESPONDED WITH HIGHEST EFFICIENCIES. D. O. VARIATIONS WITHIN THE DITCH WAS BETWEEN 5.2 AND 9.0. CAPITAL COST OF AN OXIDATION IS GIVEN AS $29 - $68/1000 POPULATION WITH AN AVERAGE OF $45. (NATIONAL COST INDEX - APRIL 1966) CONSTRUCTION COSTS ARE $0.35/GPD FOR POPULATION OF 5000 AND $0.83/GPD FOR 250. ANNUAL UNIT OPERATING COSTS ARE GIVEN AS $104.50/1,000,000 GALLONS. (W70-06069).

00263. THE INDUSTRIAL WASTES CONTROL PROGRAM IN NEW YORK CITY.

IMBELLI, C.; PRESSMAN, W.V.; RADILOFF, H.
J WATER POLLUTION CONTROL FED., 40(12), 1981-2012, 1968.

NEW YORK CITY'S ENACTMENT OF A LOCAL LAW FOR THE CONTROL OF INDUSTRIAL WASTE DISCHARGES TO THE SEWER SYSTEM IS UNIQUE BECAUSE OF THE VARIETY OF MANUFACTURES AND SERVICE TYPE INDUSTRIES INVOLVED. IN THE MIDDLE THIRTIES ACTION WAS BEGUN TO UNIFY PIECEMEAL LAWS PREVIOUSLY ENACTED AND RESULTED IN THE CHARTER OF 1938. AUTHORITY AND RESPONSIBILITY FOR THE OPERATION OF THE ENTIRE SEWER SYSTEM WAS ASSIGENED TO THE DEPARTMENT OF PUBLIC WORKS. DISCUSSION OF THE LAW, THE SURCHARGE FORMULA USED, AND THE PROBLEMS OF PROGRAM ORGANIZATION ARE COVERED EXTENSIVELY. THE SURCHARGE FORMULA INCORPORATES COST PER POUND OF REMOVING POLLUTANTS, VOLUME OF WASTEWATER DISCHARGES, CONCENTRATION OF SUSPENDED SOLIDS, AND BIOCHEMICAL OXYGEN DEMAND. THESE SURCHARGES ARE BASED ON CONCENTRATIONS OF SUSPENDED SOLIDS AND BOD OVER AND ABOVE 'NORMAL SEWAGE'. RESULTS OF PILOT STUDIES USING NEW TECHNIQUES AND DESCRIPTION OF SEVERAL UNIQUE WASTE PROBLEMS, SAMPLING METHODS, AND EQUIPMENT USED ARE INCLUDED. SEVERAL INDUSTRIES REQUIRING PRE-TREATMENT WERE DESCRIBED IN DETAIL WITH REGARD TO THEIR PARTICULAR PROBLEM. THESE WASTES WERE INDUSTRIAL LAUNDRIES, METAL PLATERS, ACID WASTES, PAINTS AND VARNISHES, COMMISSARIES, AND SOAP MANUFACTURERS. REVENUE REALIZED BY SURCHARGING IS SUBSTANTIAL. (W70-06072).

00264. MEMBRANE PROCESSES GAIN FAVOR FOR WATER REUSE.

BREGMAN, J.I.
ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 4(4), 296-302, 1970.

NEW WATER TREATMENT PROCESSES ARE NEEDED FOR CLEANUP AND REUSE OF WATER TO MEET FUTURE INDUSTRIAL AND MUNICIPAL WATER DEMANDS. CONVENTIONAL WATER AND WASTE TREATMENT PROCESSES ARE

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ONLY PARTIALLY EFFECTIVE AGAINST THE EXPANDING LIST OF COMPOUNDS CONTAMINATING THE LAKES AND RIVERS. AN EVALUATION OF 9 TERTIARY TREATMENT RESEARCH AND DEVELOPMENT PROJECTS SHOWS THAT THE COSTS OF REMOVING ORGANIC AND INORGANIC NUTRIENTS RANGE FROM 26 TO 30 CENTS PER 1000 GAL COMPARED TO 11 CENTS PER 1000 GAL FOR SECONDARY TREATMENT. HOWEVER, WASTEWATER RECLAIMED BY TERTIARY TREATMENT HAS A HIGHER ECONOMIC VALUE, OFFSETTING THE HIGHER COST OF TERTIARY TREATMENT. RESULTS OF FIELD AND LABORATORY STUDIES ARE REVIEWED ON THE USE OF REVERSE OSMOSIS FOR RECLAIMING BRACKISH WATER, ACID MINE DRAINAGE, SALINE IRRIGATION RETURN FLOW, PAPER MILL WASTE EFFLUENTS, AGRICULTURAL RUNOFF, AND MUNICIPAL WASTE WATER. PROBLEMS REMAINING INCLUDE: (1) CREATING TAILOR-MADE MEMBRANES FOR RETENTION OR PASSAGE OF SPECIFIC MATERIALS, (2) PREVENTING MEMBRANE FOULING BY ORGANICS AND OTHER TRACE CONTAMINANTS, AND (3) PREVENTING FLUX DECLINE OR RESTORATION OF FLUX. (W70-08448).

00265. COMPUTER ANALYSIS OF ENGINEERING ECONOMIC STUDIES.

BOGERT, I.L.
J WATER POLLUTION CONTROL FED., 50(12), 2033-2035, 1968.

COMPUTERS HAVE BEEN USED FOR THE FINANCIAL ASPECTS OF PROJECTS REPORTS FOR THE BERGEN COUNTY SEWER AUTHORITY, NEW JERSEY. THE REPORTS, REQUIRED BY LAW, MUST INCLUDE 40 YEARS ESTIMATES OF DOMESTIC AND INDUSTRIAL FLOWS, REQUIRED PLANT AND SEWER ENLARGEMENT DATES, CAPITAL AND ANNUAL FINANCIAL COSTS OF PRESENT SYSTEM AND ALL FUTURE ENLARGEMENTS, AND ANNUAL PLANT AND SYTEM OPERATING COSTS AND RATES APPLICABLE TO THE VARIOUS PARTICIPANTS BOTH WITH AND WITHOUT THE PROJECT BEING STUDIED. COMPUTER PROGRAMMING PERMITS REDUCED PROFESSIONAL TIME, RAPID PRODUCTION OF REPORTS, MORE THOROUGH STUDY OF POSSIBLE VARIATIONS IN DIRECT PRINTING OF CALCULATIONS FROM COMPUTER SHEETS. (W70-06080).

00266. THE RECLAMATION OF POTABLE WATER FROM SEWAGE.

STANDER, G.J.; VAN VUUREN, L.R.
WATER POLLUTION CONTROL, 68(5), 513-522, 1969.

A PILOT PLANT (1000 GAL/HR) FOR THE RECLAMATION OF POTABLE WATER WAS OPERATED USING PRIMARY AND SECONDARY SEWAGE TREATMENT PLANT EFFLUENTS. PILOT PLANT PROCESSES INCLUDED FLOTATION, AMMONIA STRIPPING, CHEMICAL STABILIZATION, AND FILTRATION, FOAM FRACTIONATION, CHLORINATION AND CARBON ADSORPTION. PRIMARY CLARIFIER AND HUMUS TANK (SECONDARY CLARIFIER FOLLOWING TRICKLING FILTERS) EFFLUENTS WERE SEPARATELY APPLIED AS PILOT PLANT INFLUENTS. VARIOUS WATER QUALITY PARAMETERS INCLUDING AMMONIA, ORGANIC NITROGEN, TOTAL NITROGEN, PHOSPHATE, ALKYL BENZENE SULPHATONATE (ABS), CHEMICAL OXYGEN DEMAND (COD), BIOCHEMICAL OXYGEN DEMAND (BOD), ESCH. COLI, AND POLIO I VIRUS WERE FOLLOWED THROUGH THE SYSTEM AND PROCESS REMOVAL CURVES ARE PROVIDED FOR EACH PARAMETER. RESULTS INDICATED THE PILOT PLANT EFFLUENT CHEMICALAND BIOLOGICAL QUALITY TO BE WELL WITHIN WHO RANGES FOR POTABLE WATER. HUMUS TANK EFFLUENT, HOWEVER, RESULTED IN A WATER CONSISTANTLY HIGH IN NITRATE-NITROGEN. COSTS WERE PROJECTED FOR A 1 MGD PLANT AND AMOUNTED TO 21.5 CENTS/1000 GAL AND 27.0 CENTS/1000 GAL FOR TREATMENT OF HUMUS TANK EFFLUENT AND PRIMARY CLARIFIED EFFLUENT, RESPECTIVELY. (W70-06083).

00267. SURVEY OF WASTE WATER RATES AND CHARGES.

DUPRE, E.E.
J WATER POLLUTION CONTROL FED., 42(1), 33-43, 1970.

THE LAFAYETTE, LOUISIANA, SEWER DEPARTMENT SURVEYED THREE CITIES IN EACH STATE OF THE U. S. TO DETERMINE THE TYPES AND BASIS FOR WASTE WATER RATES AND CHARGES APPLIED. SEVENTY-TWO CITIES RESPONDED. A TABULATION OF THESE DATA IS INCLUDED. THE DATA INCLUDE: LOCATION, CHARGES FOR EXTENTION OF SEWERS, POPULATION, TERRAIN, TYPE OF WASTE WATER TREATMENT, INFLUENT BOD, AVERAGE BOD REMOVAL, NUMBER OF PERSONNEL, SOURCES AND AMOUNTS OF REVENUE, PAYROLL COSTS, AND CURRENT SEWER RATES. (W70-06086).

00268. FEDERAL AID TO THE STATES: AN ANALYTICAL EXAMINATION OF THE ALTERNATIVES.

WEIDENBAUM, M.L.
THE AMERICAN JOURNAL OF ECONOMICS AND SOCIOLOGY 28(4), 367-383, 1969.

DUE TO THE INTRASTATE NATURE OF MANY WATER POLLUTION PROBLEMS FEDERAL ASSISTANCE IN THEIR SOLUTION HAS RECEIVED CONSIDERABLE ATTENTION AND THIS STUDY OF THE ECONOMIC PROBLEMS INVOLVED IS INFORMATIVE WITH RESPECT TO UNDERSTANDING THE EFFECTS OF FEDERAL AID TO THE STATES. THE PURPOSE OF THE ARTICLE IS TO CONTRIBUTE TO FINDING AN OPTIMAL PROGRAM FOR FEDERAL ASSISTANCE BY ARRAYING AND OBJECTIVELY COMPARING THE VARIOUS ALTERNATIVE APPROACHES. IT EXAMINES THE CASE FOR INCREASED FEDERAL FINANCIAL ASSISTANCE TO STATE GOVERNMENTS AND THEIR SUBDIVISIONS AND ANALYZES THE MAJOR ALTERNATIVE WAYS OF DISTRIBUTING THE AID. THE ALTERNATIVES EXAMINED ARE SHARED REVENUES, TAX CREDITS, DIRECT FEDERAL OPERATIONS, PROGRAM GRANTS, STRAIGHT BLOCK GRANTS, AND BLOCK GRANTS WITH AN EQUALIZATION FEATURE. THE CRITERIA FOR EVALUATION ARE INCOME DISTRIBUTION, RESOURCE ALLOCATION AND STABILIZATION. THE STUDY INDICATES THAT BLOCK GRANTS WITH AN EQUILIZATION FEATURE YIELD THE GREATST AMOUNT OF INCOME REDISTRIBUTION BUT THAT TAX CREDITS AND TAX SHARING MIGHT TEND TO RESULT IN LARGER EXPENDITURES FOR SELECTED AREAS, BASED ON THE RECENT ALLOCATION PATTERNS OF STATE BUDGETS. (W70-06410).

00269. MASTER WASTEWATER COLLECTION AND TREATMENT PLAN FOR BOGOTA, COLOMBIA.

HORSEFIELD, D.R.
J WATER POLLUTION CONTROL FED., 46(8), 1443-1458, 1969.

BOGOTA, THE CAPITAL CITY OF COLUMBIA IS LOCATED ON THE ANDES MOUNTAIN PLATEAU AND HAS A POPULATION OF 1,700,000. THE AVERAGE WASTE WATER FLOW OF 88.2 MILLION GALLON A DAY IS EXEPCTED TO INCREASE WITH AN ESTIMATED 1985 POPULATION OF 3,200,000. A MASTER PLAN IS ESTABLISHED RECOMMENDING THE CONSTRUCTION OF SEWERS AND CANALS TO CONVEY COMBINED WASTES TO POINTS OF TREATMENT PRIOR TO DISCHARGE TO RIO BOGOTA. THE FIRST STAGE PROGRAM, ($1,000,000) PRESENTLY IS UNDERWAY. THE ENTRE PRO-

JECT WILL COST $85,000,000. PROBLEMS ENCOUNTERED AND METHODS USED IN DESIGN CRITERIA ARE DISCUSSED. (W70-06579).

00270. MATERIALS OF CONSTRUCTION FOR TRADE WASTE TREATMENT PLANTS.

PARADINGTON, D.V.

WATER POLLUTION CONTROL, LONDON, 67(3), 269-275, 1968.

A GENERAL BACKGROUND IS PRESENTED RELATING TO THE DIFFICULTIES CONFRONTING THE PLANT DESIGNER WHEN SELECTING THE MATERIALS OF CONSTRUCTION FOR A TRADE TREATMENT PLANT. PARTICULAR EMPHASIS IS GIVEN TO THE CONSTRUCTION OF TANKS. CONSTRUCTION MATERIALS SHOULD HAVE CHEMICAL-RESISTING CAPACITY. ATTENTION SHOULD BE PAID TO SUCH FACTORS AS THE RISK OF MECHANICAL DAMAGE AND THERMAL CONDITIONS. SELECTIONS OF MATERIALS FOR PUMPS SHOULD BE CONSULTED WITH PUMP MANUFACTURES. THE NEED IS EMPHASIZED FOR PLASTIC PIPES. THE CHEMICAL RESISTANCES OF ANY CONSTRUCTION MATERIAL DEPENDS UPON THE INDIVIDUAL CONTAMINANTS PRESENT, AND THEREFORE IT CAN BE DANGEROUS TO GENERALIZE ANY POINT. FOR THIS REASON FINAL SELECTION OF MATERIAL SHOULD BE LEFT TO THE SPECIALIST ENGINEER. WHILE GREAT RELIANCE IS PLACED ON CONVENTIONAL TECHNIQUES, THE USE OF SYNTHETIC MATERIAL IS ASSUMING AN EVER INCREASING IMPORTANCE. (W70-06586).

00271. SEWAGE PLANT DESIGNED FOR FLUCTUATING POPULATION.

SMITH A.R.

WATER AND WASTES ENGINEERING, 7(1), P 40-41, 1970.

PLANT DESIGN DESCRIPTION IS PRESENTED OF A 2 MGD WASTEWATER TREATMENT PLANT AT DUQUESNE, PENNSYLVANIA. DESIGN DIFFERS FROM CONVENTIONAL TYPE; IT PROVIDES FOR TANKS ONE-THIRD SMALLER THAN STANDARD SIZE AND THE FACILITIES USING CONTACT STABILIZATION AND AEROBIC DIGESTION ARE ADAPTABLE TO MEET RAPID, SEASONAL OR FLUCTUATING DEMANDS, SUCH AS ENCOUNTERED DUE TO POPULATION CHANGES IN RESORT TOWNS. OPERATIONAL FLEXIBILITY AND CONSTRUCTION SAVINGS ARE DISCUSSED. OTHER IMPORTANT DEPARTURES FROM CONVENTIONAL TREATMENT ARE: PRIMARY SETTLING IS ELIMINATED; AND, THE VOLATILE CONTENT OF SLUDGE IS REDUCED IN ORDER TO DISPOSE OF ITS SOLIDS. THE SPECIFIC MODIFICATIONS IN PROCESS AND EQUIPMENT DESIGN WHICH PERTAIN TO THESE DEPARTURES ARE DESCRIBED BRIEFLY. EQUIPMENT AND SPACE REQUIREMENTS ARE GREATLY REDUCED DUE TO THE SMALLER TANKS AND USE OF COMMON WALL CONSTRUCTION FOR CONTACT STABILIZATION AND AEROBIC DIGESTION. THE KEY TO THE LOW-COST OPERATION IS THE SERIES OF 8 IDENTICAL TANKS (2 FOR CONTACT AERATION OF RAW SEWAGE, 2 FOR SLUDGE STABILIZATION, 3 FOR AEROBIC DIGESTION, 1 FOR STAND-BY); ANY TANK CAN BE USED FOR ANY PART OF THE PROCESS, AND THE NUMBER OF TANKS USED CAN BE VARIED TO MEET CHANGING DEMANDS. THE PLANT CAN BE RUN AT DESIGN CAPACITY OF 2 MGD OR AT ANY FRACTION THEREOF WITHOUT LOSS OF TREATMENT EFFICIENCY. (W70-06587).

00272. THE CONTROL AND TREATMENT OF TRADE EFFLUENTS.

GRIFFITHS, J.

WATER POLLUTION CONTROL, 67(6), 606-611, 1968.

NEEDS, MEANS, AND PRINCIPLES OF TREATMENT AND CONTROL OF FOOD FACTORY EFFLUENTS ARE DISCUSSED. SATISFACTORY DEGREES OF CONTROL MENTIONED WERE: SOLIDS REMOVAL UP TO 1500 MG/L, PRETREATMENT OF GREASE, AND OIL, PH CONTROL BY LIME OR SODA ASH ADDITION TO ACID DISCHARGES, AND PROVISION OF PETROL/OIL INTERCEPTORS. THE IMPOSITION OF CHARGES BY A LOCAL AUTHORITY FOR THE TREATMENT OF TRADE EFFLUENTS IS DISCUSSED. THE SO-CALLED 'MOGDEN-TYPE' FORMULA FOR DETERMINING THE COST OF TREATMENT HAS ENCOUNTERED CONSIDERABLE DIFFICULTY IN ACTUAL APPLICATIONS. IT CANNOT BE APPLIED EQUITABLY TO BOTH SMALL AND LARGE INDUSTRIES. ALSO, INSOFAR AS TYPES OF INDUSTRIES ARE CONCERNED THE FORMULA IS TROUBLESOME TO APPLY. SPECIAL DISCUSSIONS ENSUED BY SYMPOSIA ATTENDEES REGARDING EMPHASIZING PROBLEMS CREATED BY THE WIDE VARIATIONS IN TRADE ELLUENTS, THE EFFICIENCY OF TREATMENT AND, THE RELATIVE MERITS OF THE MODGEN-TYPE COST FORMULA. THE TREND IS TOWARD SEEKING A RATIONAL BASIS FOR TREATMENT COST IMPOSED ON INDUSTRY. (W70-06589).

00273. A REVIEW OF POULTRY WASTE DISPOSAL POSSIBILITIES.

RILEY. C.T.

WATER POLLUTION CONTROL, 67(6), 627-631, 1968.

WASTE DISPOSAL PROBLEMS IN THE POULTRY INDUSTRY, CONTEMPORARY POULTRY PRACTICE AND RELATED DEVELOPMENTS IN AGRICULTURE ARE DISCUSSED, AND TRENDS CONSIDERED. THE MAIN TYPES OF WASTE ARE ANALYZED; WASTES FROM LAYING HENS HAS HIGHER NPK VALUES THAN ANY OTHER AGRICULTURAL WASTE. A NATIONAL AGRICULTURAL ADVISORY SERVICE (AAS) SURVEY EMPHASIZED THE LACK OF KNOWLEDGE, HIGH COST OF WASTE DISPOSAL TO EGG PRODUCERS AND SOCIAL EFFECTS OF THE CURRENT TENDENCY TO INCREASE LIVESTOCK NUMBERS AND (DUE TO TRANSPORTATION COSTS) TO GROUP PRODUCTION UNITS NEAR CENTERS OF CNSUMPTION. ANALYSIS IS MADE OF WASTE QUANTITIES AND THE CHEMICAL AND PHYSICAL PROPERTIES OF THE WASTE. A RELIABLE CORRELATION APPEARS TO EXIST IN BOD FOOD INTAKE RELATIONSHIP. SETTLING DIFFICULTIES IN TREATMENT ARE NOTED. THE RELATIONSHIPS BETWEEN DISPOSAL PRACTICES AND LAND USES ARE EXAMINED. THE MAJOR PROBLEMS ARISING FROM TRADITIONAL METHODS OF DISPOSAL ARE ANALYZED, ESPECIALLY THE STORAGE AND HEAT DRYING PHASES. TRADITIONAL METHODS OF SEWAGE TREATMENT NO LONGER APPEAR SUITABLE FOR POULTRY WASTES. THE 'PASVEER DITCH' OR 'BUBLE-GUN' TYPE OF INSTALLATION MAY BE MORE SUITABLE; HOWEVER, THE HIGH CONCENTRATION OF WASTE REMAINS A PROBLEM. THE TREATMENT AND DISPOSAL OF WASTES FROM DEEP LITTER AND BROILER HOUSES IS TROUBLESOME MAINLY IF LOCAL ACCUMULATIONS BECOME TOO LARGE. THIS TYPE OF WASTE HAS THE HIGHEST NITROGEN CONTENT OF ALL AGRICULTURAL WASTES. (W70-06590).

REFERENCE LIST

00274. SLUDGE TREATMENT AND DISPOSAL AT THE BROCKHURST WORKS OF THE UPPER TAME MAIN DRAINAGE AUTHORITY.

EDMONDSON, B.R.
WATER POLLUTION CONTROL, 68(2), 146-165, 1969.

THE BROCKHURST WORKS HANDLES A 6.25 MGD DRY WEATHER FLOW, OF WHICH 2.25 MGD IS TRADE EFFLUENT. A SLUDGE PRESSING PLANT WAS INSTALLED TO SUPPLEMENT DRYING BEDS AND LAGOONS. THE PLANT WAS DESIGNED TO HANDLE 122,500 GALLONS OF DIGESTED SLUDGE CONTAINING 4.5 PERCENT DRY SOLIDS AND 192,500 GALLONS OF PRIMARY AND HUMUS SLUDGES CONTAINING 6.0 PERCENT DRY SOLIDS DURING A FIVE DAY WEEK. DESCRIPTION IS GIVEN CONCERNING THE DESIGN AND OPERATION OF THE PLANT WHICH UTILIZES LIME AND COPPERAS AS CONDITIONING AGENTS. PRIOR TO INSTALLATION OF THE PLANT BUCHNER-FUNNEL TESTS WERE RUN USING LIME AND COPPERAS, AND ALUMUINUM CHLOROHYDRATE AS CONDITIONING AGENTS. LIME AND COPPERAS WAS FOUND TO BE THE MOST EFFECTIVE. THIS RESULT WAS VERIFIED BY TESTS USING A 12 INCH SQUARE, SINGLE PLATE PRESS. TWENTY NINE POLYELECTROLYTES WERE ALSO INVESTIGATED. SEVERAL POLYELECTROLYTES REDUCED THE SPECIFIC RESISTANCE TO AN ACCEPTABLE LEVEL BUT ONLY TWO OR THREE WERE COMPETITIVE IN COST. NONE OF THE POLYELECTROLYTES WAS SUFFICIENTLY EFFECTIVE ON DIGESTED SLUDGE AND TWO REAGENTS WERE EFFECTIVE ON HUMUS SLUDGE. DATA ARE PRESENTED ON THE PERFORMANCE OF SEVERAL POLYELECTROLYTES. CAPITAL AND OPERATIONAL COST DATA ARE GIVEN. (W70-06594).

00275. EXPERIENCE WITH A WAGE INCENTIVE BONUS SCHEME AT GOSCOTE AND BROCKHURST SEWAGE WORKS.

EDMONDSON, B.R.
WATER POLLUTION CONTROL, 68(4), 437-442, 1969.

A TIME-WORK STUDY COVERING ALL THE ROUTINE OPERATIONS OF TWO SEWAGE TREATMENT WORKS WAS CARRIED OUT. BASED ON AN ADJUSTED OBSERVED TIME OF PERFORMANCE, EACH JOB WAS GIVEN A 'BASIC TIME' REQUIRED FOR JOB COMPLETION. THE TOTAL TIME ALLOWED INCLUDED REST ALLOWANCES, SPECIAL ALLOWANCES, AND SEASONAL ALLOWACES. A PERFORMANCE FACTOR WAS DEVISED RELATING ALLOWED TIME TO ACTUAL TIME. FOR EVERY PERFORMANCE POINT OVER 100, THE WORKER IS PAID A BONUS AS AN INCENTIVE TO BETTER WORK. DIFFICULTIES AROSE IN THAT IF THE WORK QUALITY FELL OFF, THE BONUSES WERE NOT PAID, AND THE MEN COULD NOT UNDERSTAND WHY THEIR PAYCHECKS DECREASED. JOB VALUES MUST BE MAINTAINED AT A FAIR RATE TO BOTH MANAGMENT LABOR. LABOR UNIONS RECOMMENDED THAT ALL LOCAL AUTHORITIES INTRODUCE INCENTIVE BONUS SCHEMES BASED ON GENUINE WORK MEASUREMENT TECHNIQUES AND HAVING REGARD TO THE CODE OF GUIDING PRINCIPLES, WHICH RECOMMENDS A BONUS OF 33 1/3% OF BASIC PAY RATE FOR A STANDARD PERFORMANCE. (W70-06595).

00276. REGIONAL MANAGEMENT OF WATER QUALITY--A SYSTEMS APPROACH.

ANDERSON, M.W., DAY, H.J.
J WATER POLLUTION CONTROL FED., 40(10), 1679-1687, 1968.

A MODIFIED STREETER-PHELPS EQUATION WAS ADAPTED TO LINEAR PROGRAMMING TO STUDY WAYS OF MINIMIZING REGIONAL OPERATION COSTS FOR A NUMBER OF WASTE WATER TREATMENT PLANTS ON A RIVER SUBJECT TO WATER QUALITY STANDARDS. THE REGION STUDIED WAS A WARM MIAMI RIVER VALLEY QUALITY FROM DAYTON TO BALTIMORE. THE PARAMETERS CONSIDERED IN THE OPTIMIZATION TECHNIQUES ARE: (1) NUMBER AND LENGTH OF REACHES AND LOCAION OF WASTE OUTFALLS, (2) WASTE LOADINGS RECEIVED BY TREATMENT FACILITIES, (3) TREATMENT AVAILABLE AT EACH OUTFALL, (4) OPERATING COST OF EACH WASTE TREATMENT FACILITY, (5) QUANTITY AND QUALITY OF TRIBUTARY FLOWS, (6) DEOXYGENATION COEFFICEINTS, (7) REOXYGENATION COEFFICIENTS, (8) VELOCITY OF RIVER IN EACH REACH, (9) TEMPERATURE OF RIVER IN EACH REACH, (10) RIVER STANDARDS OF DESIRED LEVEL (DO), AND (11) INITIAL CONDITIONS OF RIVER PRIOR TO FIRST REACH. RESULTS INDICATE THAT HIGHER DISSOLVED OXYGEN LEVELS IN A RIVER CAN BE OBTAINED AT REDUCED OPERATING COSTS. IT IS ALSO POSSIBLE TO SUGGEST WHERE FUTURE WASTE WATER TREATMENT FACILITIES SHOULD BE LOCATED TO OBTAIN MAXIUM BENEFITS. (W70-06602).

00277. BOD REDUCTION BY CHLORINATION.

SUSAG, R.H.
J WATER POLLUTION CONTROL FED., 40(1) PART 2, R434-R444, 1968.

THE EFFECT OF CHLORINATION ON DEOXYGENATION BEHAVIOR WAS INVESTIGATED IN WASTE WATERS AND TREATMENT PROCESS EFFLUENTS. REDUCTION IN BOD VALUES WAS OBSERVED ON CHLORINATION. THAT WAS MORE SIGNIFICANT, HOWEVER, WAS THE RETARDATION IN BOD EXERTION AS DEMONSTRATED BY A REDUCTION IN THE DEOXYGENATION CONSTANT K. SEVERAL TESTS WERE CONDUCTED EMPLOYING RAW WASTE WATER AS THE TEST SUBSTRATE WITH CHLORINE DOSAGES VARYING FROM 5 TO 40 MG/L AND CHLORINE CONTACT TIME VARYING FROM 30 TO 60 MINUTES. AT A CHLORINE DOSE OF 10 MG/L THE K VALUE WAS DETERMINED TO BE 0.143 WHILE THE NONCHLORINITED SAMPLE SHOWED 0.195. A COMPARISON BETWEEN EFFLUENT CHLORINATION AND ADDITIONAL TREATMENT PROCESSES INDICATED THAT ANNUAL COSTS FOR EFFLUENT CHLORINATION WOULD BE ONLY 8 TO 40% OF THE COSTS FOR THE ADDITIONAL TREATMENT PROVIDING OPERATION PERIODS TOTALED NOT MORE THAN 52 DAYS ANNUALLY. THE EXTREMELY HIGH DAILY OPERATION COSTS INDICATED THAT THE USE OF THIS METHOD IS LIMITED AS A PROCESS OPERATION TO A NON-REGULAR BASIS. THIS EXAMPLE INDICATES THAT EFFLUENT CHLORINATION HAS A PRACTICAL APPLICATION WHEN EMPLOYED SUPPLEMENT TO REASONABLE WASTE WATER TREATMENT FOR THE MAINTENANCE OF DESIRED DISSOLVED OXYGEN LEVELS AT ADVERSE RECEIVING RIVER DILUTION CONDITIONS. (W70-06606)

00278. RECONSTRUCTION OF OFFERTON SEWAGE WORKS OF HAZEL GROVE AND BRAMHALL UDC.

MORTON, J.; SUMMERFIELD, F.
WATER POLLUTION CONTROL, 68(1), 85-92 1969.

THE EXTENSION OF OFFERTON SEWAGE WORKS TO MEET TREATMENT REQUIREMENT IN 1980 IS DISCUSSED. THE DESIGN IS BASED ON A 1980 POPULATION OF 47,250 PERSONS AND A DRY-WEATHER FLOW 2.73 MIL GAL/D. THE DESIGN PROPOSALS INCLUDE A NEW MECHANICALLY-RAKED FINE SCREEN, TWO NEW STORM TANKS WHICH WILL BE CLEANED BY A TRANSFERABLE SCRAPER OPERATING IN CONJUNCTION WITH TRANSVERSE SLUDGE CONCENTRATIONS AT THE INLET END, AND A SCREW PUMP FOR RETURNING THE CONTENTS OF THE STORM TANKS FOR FULL TREATMENT. ADDITIONAL SEDIMENTATION CAPACITY WILL BE PROVIDED BY TWO 65 FT. DIA. AND 14 FT. DEEP TANKS. SECONDARY TREATMENT OF SEWAGE WILL INCLUDE A SIMPLEX SURFACE AERATION

PLANT INCORPORATING SIX HIGH-INTENSITY CONES. AUTOMATIC CONTROLS FOR MONITORING DO, SUSPENDED SOLIDS AND CONTROL OF ACTIVATED SLUDGE RETURN AND OF SLUDGE BLANKETS IN FINAL SEPARATING TANKS WILL ALSO BE INSTALLED. SITE INVESTIGATIONS WERE CARRIED OUT TO ESTIMATE THE COST OF EXTENSIONS. A CRITICAL PATH DIAGRAM FOR PRE-CONSTRUCTIONAL EVENTS IS ALSO PRESENTED. (W70-06618).

00279. EFFECTIVE CHEMICAL TREATMENT FOR INHIBITION OF ANAEROBIC SEWAGE SLUDGE DIGESTION DUE TO ANIONIC DETERGENTS.

SWANWICK, J.D.; SHURBEN, D.G.
WATER POLLUTION CONTROL, 68(2), 190-202, 1969.

A REPORT OF THE USE OF ALIPHATIC AMINES AND RELATED COMPOUNDS FOR THE TREATMENT OF ANAEROBIC SLUDGE INHIBITED BY INCREASING AMOUNTS OF ANIONIC DETERGENTS. IN INITIAL LABORATORY EXPERIMENTS AMINE HBG AND DIAMINE HPL WERE USED AS THEIR ACETATE SALTS AND ADDED AT HALF THE MOLAR EQUIVALENT OF ANIONIC DETERGENT PRESENT IN THE DIGESTERS. A MARKED RESPONSE (GAS PRODUCTION) TO AMINE HBG, AND A SMALLER TEMPORARY RESPONSE TO DIAMINE HPL WERE NOTED. FISH TOXICITY TESTS SHOWED THE 48-H MEDIAN TOLERANCE LIMIT FOR RAINBOW TROUT TO BE 35-45 MG/L AMINE HBG BUT ONLY 0.4-0.5 MG/L DIAMINE HPL. TOXICITY TESTS ALSO INDICATED THAT IN THE ABSENCE OF ANIONIC DETERGENTS, AMINE HBG WAS ITSELF TOXIC TO METHANE BACETERIA. HOWEVER, NORMAL OPERATION OF A FULL-SCALE DIGESTER WHICH HAD FAILED TO PRODUCE GAS AFTER REFILLING WAS ACCOMPLISHED BY ADDING AMINE HBG ACETATE AT HALF THE MOLAR EQUIVALENT OF DETERGENT PRESENT. (W70-06622)

00280. RECENT PROGRESS IN THE BLACKBURN MEADOWS RECONSTRUCTION AND EXTENSION SCHEME AT SHEFFIELD.

HOLYROYD, A.
WATER POLLUTION CONTROL, 68(3), 357-367 1969.

CERTAIN PHASES OF THE BLACKBURN MEADOWS RECONSTRUCTION AND EXTENSION SCHEME ARE DISCUSSED. EMPHASIS IS PLACED ON PHASES RELATING TO SETTLING TANKS AND SLUDGE INCINERATION PLANT BOTH OF WHICH ARE NEARING COMPLETION. EIGHT NEW RECTANGULAR SETTLEMENT TANKS HAVE BEEN CONSTRUCTED EACH 234 FEET BY 75 FEET, 11 FEET DEPTH AT INLET AND 10 FEET AT OUTLET. EACH TANK IS PROVIDED WITH A 'BOUYANT FLIGHT' SLUDGE SCRAPER. FLOW CONTROL IS ACCOMPLISHED BY A SEMI-AUTOMATIC SYSTEM. IN ADDITION A SYSTEM OF SLUDGE WITHDRAWAL HAS BEEN DESIGNED FOR EQUAL SLUDGE OUTPUTS FROM EACH OF THE TANKS. CONTROL OF SLUDGE BLANKET SURFACE TO ANY PREDETERMINED LEVEL IS MAINTAINED USING A PHOTO-ELECTRIC PROBE. THE FINAL DISPOSAL OF THE SLUDGE BY INCINERATION IS DISCUSSED. THE NICHOLAS-HERRESHOFF MULTIPLE HEARTH FURNACE IS RECOMMENDED FOR INCINERATION. DETAILS OF THE FEEDER SYSTEM, CONTROL ROOM, FURNACES, SHAFT COOLING AND SCRUBBER SYSTEM ARE DEALT WITH AND ESTIMATES OF THE INSTALLATIN ARE PRESENTED. (W70-06631).

00281. SYNTHESIS OF THE DISPERSION AND WASTE TREATMENT MODELS.

MUKHERJEE, S.K.
CALIFORNIA UNIV SERL REPORT NO 69-2, CHAPTER VII, P 68-77, JANUARY 1969.

A COMPLETE MODEL OF ESTUARINE WATER QUALITY MANANGEMENT WAS OBTAINED BY A SYNTHESIS OF THE DISPERSION AND WASTE TREATMENT MODELS. THE MULTICOMPONENT WATER QUALITY SIMULTANEOUSLY PROVIDED OPTIMAL PLANS OF TREATMENT AND DISCHARGE ALONG THE ESTUARY. THE ECONOMICS OF ALTERNATIVE METHODS OF QUALITY IMPROVEMENT AND COST REDUCTION SCHEMES LIKE TRANSPORTATION OF WASTE FROM ONE SECTION OF THE ESTUARY TO ANOTHER OR PROCESS CHANGES WERE STUDIED. ECONOMIC GROWTH PROJECTIONS AND OTHER MODIFICATIONS LIKE INCLUSION OF SOCIAL COSTS WERE ALSO INCORPORATED IN THIS MODEL. DUAL PRICES COULD BE USED AS A BASIS FOR A SYSTEM OF CHARGES AIMED AT EQUITABLE DISTRIBUTION OF OPERATING COSTS AMONG DISCHARGES, MOTIVATING THEM TO REDUCE WASTE DISCHARGE BY IMPROVING PRODUCTION AND WASTE TREATMENT PROCESSES. THE MAIN ADVANTAGES OF THE MODEL WERE ITS MULTICOMPONENT NATURE, AVAILABILITY OF STANDARD COMPUTER CODES FOR FAST SOLUTION, DIRECT OUTPUT OF OPTIMUM TREATMENT PLANS, AND FLEXIBILITY REGARDING VARIOUS OBJECTIVES. (W70-06688).

00282. A MODEL OF PUBLIC DECISIONS ILLUSTRATED BY A WATER POLLUTION POLICY PROBLEM.

DORFMAN, R.; JACOBY, H.D.
THE ANALYSIS AND EVALUATION OF PUBLIC EXPENDITURES: THE PPB SYSTEM SUBCOMMITTEE ON ECONOMY IN GOVERNMENT, JOINT ECONOMIC COMMITTEE, 91ST CONGRESS, WASH, DC, MAY 1969 P 226-274.

A MATHEMATICAL MODEL OF A WATER POLLUTION PROBLEM WAS CONSTRUCTED TO AID IN THE POLITICAL DECISION MAKING PROCESS. A HYPOTHETICAL RIVER BASIN WAS MODELLED TO ILLUSTRATE HOW A PROBLEM OF GOVERNMENTAL DECISION MAKING COULD BE EXPRESSED IN A FORMAL MODEL AND ANALYZED FRUITFULLY. THERE WERE A VARIETY OF HYDROLOGIC, TECHNICAL, SOCIAL, POLITICAL AND ECONOMIC ISSUES INVOLVED INCLUDING CONFLICTS OF INTEREST AMONG THE USERS OF THE BASIN'S WATER RESOURCES. THE MODEL PROVIDED A USEFUL WAY TO MANAGE THE DIVERSE KINDS OF DATA THAT WERE PERTINENT TO THE PROBLEM. THE SOLUTION OF THE MODEL DEFINED BOTH AGGREGATE AND INDIVIDUAL USER COSTS AND BENEFITS. IT ALSO PROVIDED A WAY TO COORDINATE FRAGMENTED DATA AND TO ANALYZE THE EFFECTS OF DIFFERENT ASSUMPTIONS THAT MIGHT REASONABLY BE ADOPTED. (W70-06690)

00283. A STEADY STATE OPTIMAL DESIGN OF ARTIFICIAL INDUCED AERATION IN POLLUTED STREAMS BY THE USE OF PONTRYAGIN'S PRINCIPLE.

DAVIDSON, B.; BRADSHAW, R.W.
WATER RESOURCES RESEARCH 6(2), 383-397, 1970.

OPTIMAL CONTROL THEORY BASED ON PONTRYAGIN'S MINIMUM PRINCIPLE WAS APPLIED TO THE STEADY STATE DISTRIBUTION OF ARTIFICIAL AERATION IN POLLUTED RIVERS. THE OPTIMIZATION WAS DEVELOPED FOR A GENERAL INTEGRAL TYPE COST FUNCTIONAL WITH

WEIGHTED ENERGY CONSTRAINTS THE SYSTEM EQUATIONS USED WERE OF THE CLASSICAL STREETER-PHELPS TYPE WITH AN INDUCED AERATION TERM ADDED AS THE CONTROL FUNCTION. SEVERAL OPTIMAL AND SUBOPTIMAL AERATION DESIGNS AT DIFFERENT TEMPERATURE LEVELS WERE OBTAINED USING A DIGITAL COMPUTER AND AN AUTOMATIC PLOTTING ROUTINE. AN ANALOG COMPUTER WAS USED IN THE CRITICAL STAGES OF THE NUMERICAL SOLUTIONS. RESULTS FROM THE ANALOG COMPUTER POINTED THE WAY TO THE ULTIMATE USE OF LAPLACE TRANSFORM TECHNIQUES IN CONJUNCTION WITH A DIGITAL COMPUTER FOR MAXIMUM ACCURACY. (W70-06743.

00284. BRACKISH WATER PURIFICATION BY BIOLOGICAL FUEL CELL POWERED ELECTRODIALYSIS.

SCHELLER, W.A.; GEORGI, C.E.
NEBRASKA UNIVERSITY WATER RESOURCES CENTER TECHNICAL REPORT, SEPTEMBER 1, 1969. 24 P.

SAMPLES OBTAINED FROM FOUR BRACKISH WELLS IN EASTERN NEBRASKA AND TWO NACL SOLUTIONS WERE USED IN CONJUNCTION WITH A LABORATORY ELECTRODIALYSIS UNIT TO ESTABLISH THE PROCESS PARAMETERS NECESSARY FOR ESTIMATING THE COST OF DESALINATION. INVESTMENT AND MAINTENANCE ESTIMATES FOR A 1000 GPD ELECTRODIALYSIS UNIT WERE ALSO OBTAINED. THE COST OF FRESH WATER (500 PPM TOTAL SOLIDS) PRODUCED FROM BRACKISH WATER (980 TO 6460 PPM OF TOTAL SOLIDS) WAS $2.30 TO $7.78 PER 1000 GALLONS INCLUDING A 5% COST FOR INVESTMENT CAPITAL. AT A TYPICAL RURAL CONSUMPTION OF 60 GALLONS PER PERSON PER DAY, THE ABOVE FRESH WATER COSTS ARE EQUIVALENT TO 14 CENNTS TO 48 CENTS PER PERSON PER DAY. THESE FIGURES ASSUME ELECTRIC POWER IS AVAILABLE AT 3.3 CENTS/KWH, A TYPICAL RURAL NEBRASKA RATE. IF THE ELECTRODIALYSIS UNIT WERE SUPPLIED WITH BRACKISH WATER FROM AN EXISTING PRESSURIZED SYSTEM AND WITH REDUCED MAINTENANCE COSTS, THE DESALINATED WATER COSTS WOULD BE REDUCED BY 57 CENTS TO $1.59 PER 1000 GALLONS, DEPENDING ON THE SPECIFIC CASE. (PB-191 871) (W70-06755).

00285. ESTIMATING CONSTRUCTION COSTS OF WASTE WATER TREATMENT SYSTEMS.

FARROW, J.C.; HIRTH, L.J.; JUDKINS, J.F. JR.
TEXTILE CHEMIST AND COLORIST. 2(3), 35-40 1970.

A SURVEY REVEALED THAT WASTE WATER FROM 30 TEXTILE PLANTS IN ALABAMA AND WEST GEORGIA IS DISCHARGED PRINCIPALLY TO CITY SEWERS WITH SOME PRIOR TREATMENT. FLOWRATES VARY FROM 0.03 TO 7.00 MILLION GALLONS PER DAY WITH BOD RATES AS HIGH AS 40,000 LBS A DAY. USING ESTIMATION METHODS FOR BOD BASED ON CLOTH PRODUCTION AND PROCESSING OPERATIONS, CONSTRUCTION COST[illegible]XCLUDING LAND) ARE ESTIMATED FOR TRICKLING [illegible]R, ACTIVATED SLUDGE AND MECHANICALLY AERA[illegible] REATMENT UNITS. THE COOSTS ARE FOR WASTE WATER FLOWRATES FROM 0.25 TO 6.00 MILLION GALLONS A DAY WITH BOD PARAMETERS OF 300,450 AND 700 PPM. MECHANICAL AERATION OFFERS THE LOWEST COST. (W70-06842).

00286. OBJECTIVES TECHNOLOGY, AND RESULTS OF NITROGEN AND PHOSPHORUS REMOVAL PROCESSES.

WUHRMANN, K.
ADVANCES IN WATER QUALITY IMPROVEMENT, UNIV OF TEXAS PRESS, 1968.

DISCUSSED ARE THE OBJECTIVES OF NUTRIENT REMOVAL PROCESSES, THE TYPES AND AMOUNTS OF NUTRIENTS TO BE REMOVED AND THE PERSPECTIVE SUCCESS OF TERTIARY TREATMENT. PAPER ANALYYZES PROCEDURES FOR THE ELIMINATION OF PHOSPHORUS FROM SEWAGE, INCLUDING A THOROUGH EXPLANATION OF IRON (III) AS A PRECIPITANT, PHOSPHORUS ELIMINATION USING LIME AND, PHOSPHORUS REMOVAL WITH BOTH LIME AND IRON (III). THE REMOVAL OF NITROGEN COMPOUNDS FROM SEWAGE IS DISCUSSED FROM THE VIEWPOINTS OF GENERAL PROCESS LAYOUT, THE PROCESS OF NITRIFICATION IN ACTIVATED SLUDGE TREATMENT, DENITRIFICATION BY ACTIVATED SLUDGE, THE ROLE OF OXYGEN AS A LIMITING FACTOR, THE RESPIRATION SUBSTRATES AS LIMITING FACTORS AND RESULTS OF PRACTICAL EXPERIMENTS WITH DENITRIFICATION CONDUCTED AT A PILOT PLANT STATION. DISCUSSED ARE CERTAIN COST-JUSTIFIABLE, BENEFICIAL SIDE EFFECTS OF NITROGEN AND PHOSPHORUS REMOVAL PROCESSES. ALSO PRESENTED ARE DETAILED ESTIMATES OF ANNUAL AND NET OPERATION COSTS AND DESIGN FACTORS FOR PHOSPHORUS AND NITROGEN REMOVAL PLANTS. CONCLUSIONS ARE REACHED THAT THE CONVENTIONAL BIOLOGICAL TREATMENT WILL STILL REPRESENT THE BASIS OF ALL FURTHER PURIFICATION STEPS, BOTH FOR ECONOMIC AND PROCESS REASONS. FURTHER, PAST SCIENTIFIC AND MONETARY INVESTMENT IN SEWAGE PURIFICATION WILL NOT LOSE ITS VALUE, NOT EVEN IN VIEW OF EVENTUAL TOTALLY NEW PROCEDURES GENERATED BY DEMANDS FOR MUCH HIGHER, SEWAGE EFFLUENT QUALITIES. (W70-04764).

00287. BASIS FOR WASTE STABILIZATION POND DESIGNS.

GLOYNA, E.F.
ADVANCES IN WATER QUALITY IMPROVEMENT, UNIV OF TEXAS PRESS, 1968. P 397-408.

MANY PROBLEMS ARISING FROM USE OF WASTE STABILIZATION PONDS ARE TRACEABLE TO INADEQUATE ENGINEERING, POOR MAINTENANCE AND LACK OF OPERATIONAL SUPERVISION. HOWEVER, THERE IS A MORE FUNDAMENTAL NEED: DESIGN AND ENGINEERING FOR SYSTEMS USING STABILIZATION PONDS MUST BE BASED ON AN UNDERSTANDING OF THE PRINICPLES OF ALGAL PHYSIOLOGY. GENERALLY, ALGAE GROWING IN A STREAM OR A WASTE STABILIZATION POND ARE IN A HIGHLY COMPETITIVE ENVIRONMENT. ONE OR MORE OF THE FACTORS NECESSARY FOR PHOTOSYNTHESIS ARE INTERRELATED, AND UNICELLULAR ALGAE, IN PARTICULAR WILL REACT RAPIDLY TO ENVIRONMENTAL CHANGES. ILLUMINATION, TEMPERATURE, AND NUTRIENTS--THE FACTORS WHICH AFFECT GROWTH RATE ARE EXAMINED CRITICALLY. THE PHENOMENA OF ALGAL PHYSICOLOGY, TOGETHER WITH ACTUAL TREATMENT OBJECTIVES ARE SYNTHESIZED IN GOOD DESIGN. IN THE FINAL ANALYSIS, THE SPECIFIC DESIGN OF A WASTE STABILIZATION POND DEPENDS HEAVILY UPON THE SPECIFICALLY-IMPOSED TREATMENT OBJECTIVES AND REQUIREMENTS. A POND SYSTEM MAY BE DESIGNED TO RECEIVE UNTREATED SEWAGE OR INDUSTRIAL WASTES, PRIMARY OR SECONDARY TREATMENT EFFLUENTS OR EXCESS ACTIVATED SLUDGES AND SETTLEABLE SOLIDS. CERTAIN CRITICAL FACTORS IN DESIGN DEVELOPMENT ARE DISCUSSED, BASED ON OPERATIONAL EXPERIENCES AND RESEARCH WHICH PROVIDE VITAL INSIGHTS INTO ENVIRONMENTAL FACTORS GOVERNING WASTE STABILIZATION PROCESSES. (W70-04786)

COST ANALYSIS OF WATER POLLUTION CONTROL

00288. STABILIZATION PONDS IN THE CANNING INDUSTRY.

CANHAM, R.A.
ADVANCES IN WATER QUALITY IMPROVEMENT, UNIV OF TEXAS PRESS, 1968. P 464-476.

THE CANNING INDUSTRY BEGAN AT THE TURN OF THIS CENTURY TO USE THE LAGOON METHOD FOR WASTE TREATMENT. HOWEVER, THE INDUSTRY REGARDED THIS METHOD AS DISPOSAL RATHER THAN TREATMENT, AND GENERALLY THIS PHILOSOPHY STILL PREVAILS. EARLY LAGOONS SERVED ESSENTIALLY AS ABSORPTION AREAS PROVIDING FOR WASTEWATER INFILTRATION INTO SUBSURFACE WATERS, SUBJECT TO THE VAGARIES OF SOIL CONDITIONS AND WASTE PROPERTIES. LATER LAGOON TYPES SERVED MAINLY AS SEASONAL WASTE STORAGE AREAS. INCREASING ODOR PROBLEMS LED TO WIDESPREAD PRACTICE OF USING SODIUM NITRATE, BUT RESULTS WERE UNSUCCESSFUL DUE TO THE COST OF NITRATES AND THE CONSEQUENT REDUCTION IN QUANTITIES USED. LAGOON USE DECLINED, AS OTHER LAND METHODS, SUCH AS SPRAY IRRIGATION, WERE INTRODUCED. THE COMBINATION AEROBIC-ANAEROBIC SYSTEM WAS STUDIED, FOUND EFFECTIVE FOR TREATMENT, BUT THE ODOR PROBLEM REMAINED. THE FOLLOWING METHODS WERE TESTED BUT FOUND INADEQUATE: INNOCULATIONS WITH PURE CULTURES, ODOR MASKING AGENTS, BIOCATALYST ADDITIVES SUCH AS ENZYMES, AND AERATED LAGOONS. OPERATIONAL VARIATIONS WERE TRIED, BUT THE ODOR PROBLEM REMAINED. A MORE REALISTIC LAGOON DESIGN AND COST APPROACH IS ESSENTIAL TO MAKE THE LAGOON METHOD EFFECTIVE FOR THE CANNING INDUSTRY. THIS MEANS GREATER COST, MORE LAND, MORE CHEMICALS OR AERATION. (W70-04792.

00289. WASTE STABILIZATION POND PRACTICES IN THE PULP AND PAPER INDUSTRY.

GELLMAN, I.; BERGER, H.F.
ADVANCES IN WATER QUALITY IMPROVEMENT, UNIV OF TEXAS PRESS. 1968. P 492-496.

THE STABILIZATION POND TECHNIQUE IS USED PREDOMINANTLY FOR PULP AND PAPER MILL EFFLUENTS. DATA FROM SOUTHERN KRAFT MILL OPERATIONS INDICATE THAT POND DESIGN LOADINGS OF ABOUT 50 LBS OF BOD5/ACRE/DAY ENABLE AT LEAST 85% BOD REMOVAL; LOADINGS BELOW 50 LBS PROVIDE BOD REMOVALS EXCEEDING 90%; INCREASED LOADINGS RESULTS IN A LEVELLING-OFF OF BOD REMOVALS RANGING FROM 60 TO 70 LBS/ACRE/DAY. HIGHER BOD REMOVALS(UP TO 150 LBS/ACRE/DAY) CAN BE ATTAINED USING MULTIPLE-POND SYSTEMS; HOWEVER, HIGH REMOVAL OPERATIONS ARE ACCOMPANIED BY ANAEROBIC ODOR PRODUCTION, EMISSION OF SULFIDES, AND SULFIDE OXIDIZING BACTERIA. LABORATORY AND PILOT PLANT STUDIES OF AERATED STABILIZATION BASIN PROCESS BY THE NATIONAL COUNCIL FOR STREAM IMPROVEMENT AND ITS MEMBER MILLS HAVE LED TO RAPID ACCEPTANCE AND EXTENSIVE APPLICATION. THE AERATED BASINS CAN REMOVE 40-60 LBS BOD/ACRE/DAY, WITHOUT ANAEROBIC ODOR PRODUCTION; THIS CORRELATES WELL WITH NATURAL REAERATION RATES FOR SHALLOW BASINS. CONSTRUCTION AND OPERATING COSTS FOR AERATED STABILIZATION POND TREATMENT ARE ABOUT 60% AND 40%, RESPECTIVELY, OF ACTIVATED SLUDGE TREATMENT, IN THE 90% BOD REMOVAL RANGE. (W70-04794).

00290. 'BALAS' ALGORITHM FOR ZONED UNIFORM TREATMENT.

LIEBMAN, J.C.; MARKS, D.H.
ASCE J SANITARY ENGINEERING, PAPER 6059, 585-593, 1968.

THE BASIC OBJECTIVE OF WATER-QUALITY MANAGEMENT IS TO FIND THE SOLUTION TO A POLLUTION ABATEMENT PROBLEM THAT ACHIEVES A SPECIFIED QUALITY CONDITION IN THE WATERCOURSE IN A LEGALLY EQUITABLE AND ECONOMICALLY EFFICIENT MANNER. THIS PROBLEM HAS BEEN APPROACHED IN VARIOUS WAYS; (1) UNIFORM-TREATMENT SCHEMES IN WHICH ALL DISCHARGES INTO STREAMS ARE GIVEN EQUAL TREATMENT; (2) COST-MINIMIZATION SCHEMES IN WHICH MATHEMATICAL OPTIMIZATION METHODS ARE USED TO ACHIEVE DESIRED QUALITY AT MINIMUM TREATMENT COSTS. OPTIMIZATION SCHEMES HAVE BEEN RESISTED BECAUSE THEY INVOLVE INDIVIDUAL LOCAL INEQUITIES IN TREATMENT OF DISCHARGES EVEN THOUGH FROM A REGIONAL VIEWPOINT, QUALITY STANDARDS AND COSTS ARE OPTIMAL. COMPROMISE CONCEPT CALLED, 'ZONED UNIFORM, ' IS SUGGESTED. CONCEPT IS BASED ON CLASSIFYING WASTE DISCHARGES INTO 'UNIFORM ZONES' (BOTH GEOGRAPHICAL AND CATEGORICAL IN NATURE) WITH EACH WASTE SOURCE GIVEN SIMILAR TREATMENT TO THAT OF SIMILAR SOURCES. TOTAL COST IS THEN MINIMIZED AS LONG AS TREATMENT LEVEL IS MAINTAINED IN EACH ZONE. AN ENUMERATION SCHEME SOLUTION IS PRESENTED USING DELAWARE ESTUARY DATA. (W70-04796).

00291. ANAEROBIC DIGESTION TREATS COTTON MILL DE-SIZE WASTES.

BUSWELL, A.M.; INGOLS, R.S.
WASTES ENGINEERING, 33(8), 402-404, 428, 1962.

THE DE-SIZING LIQUORS MAY PROVIDE AS MUCH AS ONE-HALF OF THE BIOCHEMICAL OXYGEN DEMAND LOAD AND ONLY 10% OF THE LIQUID EFFLUENT FROM A TEXTILE MILL. THEREFORE IT MAY BE ADVISABLE TO TREAT THIS CONCENTRATED MATERIAL SEPARATELY AND THIS CAN OFTEN BEST BE DONE BY ANAEROBIC DIGESTION. MOST OF THE SIZE REMOVED IS STARCH OR STARCH DERIVATES. LABORATORY EXPERIMENTS WERE MADE ON PURE SOLUTIONS OF SUCH MATERIALS. ABOUT 90% OF CHEMICAL OXYGEN DEMAND WAS DESTROYED IN AN AEROBIC DIGESTION WIT.I THE GAS PRODUCED BEING QUITE VARIABLE AS COMPARED WITH THE THEORETICAL YIELD. A CAPITAL COST OF $40.00 PER POUND, PER DAY FOR DIGESTERS WAS ESTIMATED. (W70-04807).

00292. TEXTILE WORKS EFFLUENT TREATMENT.

LITTLE, A.H.
TEXTILE INSTITUTE AND INDUSTRIES, 1, 9-11, 1963.

THE AUTHOR DISCUSSES THE EFFECT OF RECENT BRITISH LEGISLATION CONCERNING POLLUTION ON THE TEXTILE INDUSTRY, AND INDICATES TYPICAL REQUIREMENTS FOR THE DISCHARGE OF WASTE WATERS TO MUNICIPAL SEWERS AND TO SURFACE WATERS. HE OUTLINES POSSIBLE METHODS OF TREATMENT FOR TEXTILE WASTE WATERS AND INDICATES SOME OF THE COSTS OF TREATMENT AND DISPOSAL. (W70-04831).

REFERENCE LIST

00293. THE ECONOMICS OF URBAN SEWAGE DISPOSAL.

DOWNING, P.B.
FREDERICK A. PRAEGER, PUBLISHERS, 111 FOURTH AVENUE, N.Y., 196 P, 1969.

COST-BENEFIT ANALYSES WERE APPLIED TO THE COLLECTION AND TREATMENT OF URBAN SEWAGE (EXCLUDING STORM WATER RUNOFF) WITH THE FOLLOWING RESULTS: (1) THE COST PER CAPITA PER MILLION GALLONS PER DAY OF VOLUME FOR COLLECTION, TRANSMITTING, AND TREATING SEWAGE DECLINED AS THE NUMBER OF PEOPLE SERVED INCREASED. (2) A NET SAVINGS OF $1.55 PER PERSON YEARLY WOULD ACCRUE TO A MUNICIPALITY IF INDIVIDUAL GARBAGE GRINDERS WERE USED IN LIEU OF GARBAGE COLLECTION. (3) TO ASSESS THE COST OF THE VARIATION IN FLOW IN A FIXED-CAPACITY TREATMENT PLANT, THE COST OF INCREASING THE SEWER CAPACITY RESERVED FOR EACH INDIVIDUAL BY 25 GALLONS PER DAY WAS ESTIMATED TO BE 3 CENTS PER CAPITA PER YEAR PER MILE OF SEWER. (4) IF A PLANT SERVING 100,000 PEOPLE WERE INCREASED IN CAPACITY TO TREAT THE EXPECTED HOURLY PEAK FLOW AT 90 PERCENT, THE COST OF TREATMENT WOULD INCREASE FROM $2.07 TO $3.48 PER CAPITA PER YEAR. (5) TREATMENT FACILITIES SHOULD BE EXPANDED TO SERVICE URBAN 'FRINGE' AREAS, IF SOIL CONDITIONS ARE POOR AND IF THERE IS A NET EXTERNAL COST TO THE SEPTIC TANK SYSTEM. (6) THE MARGINAL COST OF SERVING AN INCREASE IN URBAN POPULATION DENSITY WAS ESTIMATED TO BE 64 CENTS PER CAPITA PER YEAR. (7) FOR A HYPOTHETICAL URBAN COMPLEX OF 102,400 PEOPLE, WITH VARYING POPULATION DENSITIES, ONE TREATMENT PLANT WAS ALWAYS CHEAPER THAN TWO PLANTS. (8) A CITY OF 10,000 WOULD HAVE TO BE LESS THAN TEN MILES FROM THE EDGE OF A CITY OF 100,000 BEFORE IT WOULD BE ECONOMICAL TO SEND THE SMALL CITY'S SEWAGE TO THE LARGE CITY'S PLANT. (9) LARGE SAVINGS IN POLLUTION DAMAGE WOULD BE NECESSARY BEFORE A REGIONAL TREATMENT PLANT WOULD BE ECONOMICALLY FEASIBLE. (10) THE EFFLUENT CHARGE SYSTEM FOR WASTE DISCHARGE SHOULD BE ADOPTED TO ENHANCE THE 'STREAM STANDARDS' FOR WATER QUALITY. (11) THREE SPECIAL CHARGES TO AID FINANCING OF URBAN SEWAGE FACILITIES WERE SUGGGESTED: (A) A SPECIAL ADJUSTMENT OF RATES TO ALLOW FOR DIFFERENCES IN SEWAGE STRENGTH FOR LARGE INDUSTRIAL CUSTOMERS, (B) A HIGHER PEAK LOAD PRICE FOR LARGE CUSTOMERS WHO RELEASE WIDELY VARYING LOADS, AND (12) A SPECIAL CHARGE FOR CUSTOMERS WHO DO NOT INSTALL A GARBAGE GRINDER. (W70-04648).

00294. THE CHARACTERISTICS AND POLLUTIONAL PROBLEMS ASSOCIATED WITH PETROCHEMICAL WASTES, SUMMARY REPORT.

GLOYNA, E.F.; FORD, D.L.
WATER POLLUTION CONTROL RESEARCH SERIES, FEBRUARY 1970. 98 P.

EACH OF THE MAJOR PROCESSES DEVELOPED BY THE INDUSTRY SHOULD BE STUDIED WITH THE OBJECTIVE OF EVALUATING THE TRENDS IN PLANT LOCATIONS, EFFECTS ON WATER QUALITY, AND TREATMENT REQUIREMENTS. SINCE THERE WILL BE NO SIGNIFICANT CHANGES IN PETROCHEMICAL FEEDSTOCKS, THE PATTERNS OF FEEDSTOCK USAGE SHOULD BE MONITORED AND MAJOR CHANGES EVALUATED IN TERMS OF THE WATER USE AND WATER REUSE REQUIREMENTS, POTENTIAL POLLUTION PROBLEMS, AND PRODUCT DEVELOPMENT. BECAUSE THE MAIN CNTRIBUTION TO ENVIRONMENTAL POLLUTION FROM THE PETROCHEMICAL INDUSTRY EMANATES FROM PROCESS WASTE STREAMS, COMPARATIVE COST ANALYSIS SHOULD BE MADE ON TYPICAL RECYCLE (FEEDSTOCK) PRACTICES AND ON ASSOCIATED WASTE WATER TREATMENT REQUIREMENTS. A COMPREHENSIVE AND COORDINATED EVALUATION PROGRAM SHOULD BE DEVELOPED SPECIFICALLY FOR STANDARDIZING THE CHARACTERIZATION TECHNIQUES OF WASTEWATER CONTAINING COMPLEX AND UNDEFINABLE PETROCHEMICAL AND RELATED WASTEWATER CONSTITUENTS. LARGE VOLUMES OF WASTEWATER COULD BE REUSED WITHIN THE PLANTS WITH VARYING DEGREES OF TREATMENT; WASTEWATER REQUIRES SOME FORM OF PRIMARY PRODUCT RECOVERY AND TREAT MENT, OIL REMOVAL, SETTLEABLE SOLID REMOVAL, AND REDUCTION IN THE ORGANIC CONTENT. MASTER PLAN FOR IN-PLANT WASTEWATER COLLECTION SHOULD INCLUDE FACILITIES TO SEGREGATE PROCESS WASTE FROM LESS CONTAMINATED STREAMS. PROBLEM AREAS IN THE PHYSICAL, CHEMICAL AND BIOLOGICAL TREATMENT PROCESSES, AS WELL AS DISPOSAL METHODS, ARE LISTED. A DETAILED AND BASIC STUDY SHOULD BE INITIATED TO EVALUATE THE COST OF TREATING WASTES FROM SINGLE PLANTS OR PROCESS STREAMS WITH COMBINED WASTES FROM SEVERAL PLANTS. (PB-192 310) (W70-07511).

00295. THE INCINERATION OF SOLID AND LIQUID WASTE AT FABENFABRIKEN BAYER.

FABIAN, H.W.
PROCEEDINGS OF THE INDUSTRIAL WASTE CONFERENCE, 23RD, 874-882, 1968.

OF THE 500,000 CUBIC METERS OF WASTES PRODUCED ANNUALLY AT THE LEVERKUSEN WORKS OF FARBENFABRIKEN BAYER, 40,000 METRIC TONS OF SOLID, PASTY, AND LIQUID WASTES CAN BE INCINERATED. AN INCINERATOR PLANT, BUILT IN 1967 AT A COST OF 18 MILLION D-MARKS DISPOSES OF THESE WASTES AT A COST OF 80-100 D-MARKS PER METRIC TON. INCINERATION OF MOST WASTES OCCURS IN A ROTARY KILN 12 METERS BY 3 METERS, WITH DETENTION TIMES OF 30-60 MINUTES AT A TEMPERATURE OF 1200 DEG C. SOLID WASTES ARE REDUCED 90% BY VOLUME, AND 70% BY WEIGHT. WASTE GASES (60,000-70,000 NM3/HR) ARE SENT THROUGH A SYSTEM OF AFTERBURNERS AT 1200 DEG C AND THEN TO A SERIES OF HEAT EXCHANGERS BEFORE DISCHARGE THROUGH A 100 METER STACK. UP TO 25 METRIC TONS OF STREAM ARE RECOVERED PER HOUR AT 400 DEG C AND 40 KG/SQ CM. WASTES WITH CHLORINE ARE BURNED IN ANOTHER FLAME TUBE AND THE WASTE GASES ARE TREATED SEPARATELY IN A WATER SCRUBBER WHICH HAS AN EFFICIENCY OF 95% AND REDUCES THE WASTE GAS TO LESS THAN 1000MB/HM3HCL, THE UPPER LIMIT SPECIFIED BY THE AUTHORITIES. UPON COMPLETION OF A SEWAGE TREATMENT PLANT, ANOTHER 150,000 CUBIC METERS OF SLUDGE WILL BE INCINERATED AT THIS PLANT EACH YEAR. (W70-07707).

00296. ECONOMIC ASPECTS OF SOLID WASTE DISPOSAL AT SEA.

DEVANNEY, J.W. III; LIVANOS, V.; PATELL, J.
SEA GRANT PROJECT OFFICE, REPORT NO. MITSG 71-2, NOVEMBER 20, 1970.

A COMPARISON OF THE MARKET COSTS OF DIFFERENT SOLID WASTE DISPOSAL ALTERNATIVES IS MADE THROUGH PRESENT VALUE ANALYSIS. UNIT MARKET DISPOSAL COSTS ARE DERIVED FOR SANITARY LAND FILL BY RAIL HAUL, LAND INCINERATION, DUMPING OF COMPACTED BALES AT SEA AND SEA INCINERATION. THE POTENTIAL ECOLOGIAL PROBLEMS OF EACH SYSTEM ARE CONSIDERED. NEW YORK CITY IS USED AS AN EXAMPLE TO PROVIDE A REALISTIC PICTURE OF THE POTENTIAL AND ECONOMIC ASPECTS OF SOLID WASTE DISPOSAL AT SEA. (W71-05808).

COST ANALYSIS OF WATER POLLUTION CONTROL

00297. URBAN PLANNING ASPECTS OF WATER CONTROL.

GRAVA, S.

COLUMBIA UNIVERSITY PRESS, NEW YORK, 1969, 223 P.

THIS BOOK CONSIDERS THE VARIOUS TECHNIQUES AND METHODS AVAILABLE IN WATER POLLUTION CONTROL AND THEIR ROLE IN COMMUNITY PLANNING. THE SOURCES OF POLLUTION, TREATMENT SYSTEMS ALONG WITH RELATED FINANCIAL AND ADMINISTRATIVE CONSIDERATIONS ARE DISCUSSED TO PROVIDE BACKGROUND MATERIAL IN THE PLANNING FOR WASTE CONTROL. THE AUTHOR ANALYZES WATER POLLUTION PROBLEMS WITHIN THE CONTEXT OF THE ENTIRE WATERSHED BASIN AND FORMULATES A MODEL RELATING POLLUTION CONTROL AND WASTE MANAGEMENT TO LOCAL ECONOMIC AND ECOLOGICAL CONSIDERATIONS. THIS ANALYSIS PROVIDES THE BASIS FOR COST-BENEFIT ANALYSIS OF A PARTICULAR WATERSHED. THE PLANNING ORGANIZATION FOR WATERSHED OR COMMUNITY POLLUTION CONTROL SYSTEMS REQUIRES THE FORMULAION OF OBJECTIVES, TRANSLATION OF OBJECTIVES TO GUIDELINES AND STANDARDS, PLAN PREPARATION AND EVALUATION ALONG WITH MEANS OF PLAN EXECUTION. THE INFLUENCE OF POPULATION DENSITY AND SETTLEMENT PATTERNS ALSO AFFECT WASTE MANAGEMENT PLANNING FOR COMMUNITIES. (W71-05944).

00298. A MODEL OF PUBLIC DECISIONS ILLUSTRATED BY A WATER POLLUTION POLICY PROBLEM.

DORFMAN, R.; JACOBY, H.P.

PUBLIC EXPENDITURES AND POLICY ANALYSIS, CHICAGO, MARKHAM PUBLISHING COMPANY, P 173-231, 1970.

THIS ARTICLE ATTEMPS TO PRESENT A COMPLICATED PROBLEM OF GOVERNMENT DECISION-MAKING IN TERMS OF A FORMAL MODEL. THE HYPOTHETICAL CASE DEVISED FOR THIS PURPOSE INCORPORATED MANY OF THE SALIENT FEATURES OF REAL WATER POLLUTION CONTROL PROBLEMS INCLUDING A WIDE VARIETY OF HYDROLOGICAL, TECHNICAL, SOCIAL, POLITICAL AND ECONOMIC ISSUES. DEEP SEATED CONFLICTS OF INTERESTS AMONG THE PARTICIPANTS WAS ALSO INCORPORATED. THE MODEL WAS IMPLEMENTED AND PROVIDED INTELLIGIBLE RESULTS. THE MODEL UTILIZED SUCH DATA AS BECAME AVAILABLE AND THEN PROVIDED A METHOD OF ANALYZING THE WAY DIFFERENT ASSUMPTIONS WOULD AFFECT VARIOUS PLANS LIKELY TO BE ADOPTED BY THE DECISION-MAKING COMMISSION. IT INCORPORATED INFORMATION ABOUT THE COMMISSION AND ALSO PROVIDED A FRAMEWORK FOR PREDICTING POLITICAL JUDGMENTS ABOUT THE VARIOUS POSSIBLE DECISIONS. THE MODEL IS READILY APPLICABLE TO THE CIRCUMSTANCES OF THE ASSUMPTION IN WHICH IT WAS BASED, NAMELY THAT A WATER POLLUTION CONTROL COMMISSION IS RESPONSIVE TO THE WISHES OF ITS CONSTITUENCY. THE MATHEMATICAL ANALYSIS PRESENTED IN THIS ARTICLE IS DESIGNED TO BE OF ASSISTANCE IN UNDERSTANDING AND FACILITATING THE LENGTHIER AND MORE CUMBERSOME DECISION-MAKING PROCESSES IN CURRENT USE. (W71-05939).

00299. OPTIMUM INVESTMENT IN WATER POLLUTION CONTROL.

JOHNSON, E.L.

EVALUATION PROCESSES IN WATER RESOURCES PLANNING, URBANA, ILLINOIS, AMERICAN WATER RESOURCES ASSOCIATION, P 41-57, JULY 1970.

THIS PAPER CONSIDERS THE OPERATIONALIZATION OF OPTIMUM INVESTMENT IN WATER POLLUTION CONTROL. CURRENT ATTEMPTS AT OPTIMIZATION RESULT IN SUBOPTIMIZATION OF COSTS BECAUSE INTERRELATIONS AMONG AIR, WATER, AND SOLID WASTES ARE NOT TREATED. INVESTMENT IS OPTIMIZED SUBJECT TO THE SECONDARY TREATMENT AND ANTI-DEGRADATION RESTRICTIONS SET BY WATER QUALITY STANDARDS. WITHIN THE CONTEXT OF WATER QUALITY STANDARDS, THE OBJECTIVE FUNCTION TENDS TO BE CHARACTERIZED BY CONSTRAINED COST EFFECTIVENESS. RECENT RESEARCH HAS QUESTIONED THE BASIS UPON WHICH WATER QUALITY PLANS ARE PREPARED AND HENCE DISTURBED THE PREDICTED RELATION BETWEEN POLLUTION ABATEMENT AND ENVIRONMENTAL QUALITY. INADEQUATE IMPLEMENTATION BY INSTITUTIONS OF PLANS FOR WATER POLLUTION CONTROL IS ANOTHER OBSTRUCTION TO OPTIMUM INVESTMENT. THE AUTHOR CONCLUDES THAT THE MAJOR RESEARCH AREAS FOR OPTIMIZATION ARE ECONOMIC EVALUATION, REFORM OF POLITICAL AND GOVERNMENTAL INSTITUTIONS, DEVELOPMENT OF MEANS OF MEASURING SOCIAL PREFERENCE AND THEN INTRODUCING THESE INTO THE SYSTEMS ANALYSIS PART OF INVESTMENT OPTIMIZATION. (W71-05938).

00300. PESTICIDE RESIDUES AND ENVIRONMENTAL ECONOMICS.

EDWARDS, W.F.; LANGHAM, M.R.; HEADLEY, J.C.

NATURAL RESOURCES JOURNAL, 10(4), P 719-741, 1970.

THE RELATIONSHIP BETWEEN EXTERNALITIES AND PUBLIC POLICY IN ENVIRONMENTAL QUALITY MANAGEMENT ARE CONSIDERED. DISPUTES CREATED BY EXTERNALITIES CAN BE SETTLED THROUGH PARTICIPATORY DECISION-MAKING BUT POLICY DECISIONS REACHED IN THIS WAY DO NOT REPRESENT SOCIAL COSTS AND BENEFITS PRECISELY. IF SOCIAL COSTS AND BENEFITS ARE THE MAJOR DETERMINANTS OF PUBLIC POLICY THEN BETTER MEASURES OF SOCIAL WELFARE ARE NECESSARY. THE AUTHOR PRESENTS TWO STUDIES WHICH PROVIDE EMPIRICAL MEASURES FOR PESTICIDE POLICY-MAKING. THE FIRST STUDY MEASURES THE PRODUCTIVITY OF PESTICIDES FOR U. S. AGRICULTURE AS A WHOLE. THE SECOND STUDY TRIES TO INCLUDE EXTERNALITIES IN A POLICY DECISION MODEL TO DETERMINE WHICH OF TWO PESTICIDE POLICIES IS OPTIMAL FROM A SOCIAL WELFARE POINT OF VIEW. THE MEASURE OF SOCIAL WELFARE USED IN THIS STUDY CONSISTED OF CONSUMERS' SURPLUS PLUS PRODUCERS' SURPLUS MODIFIED FOR EXTERNALITIES. THIS MODEL IS CAPABLE OF INCLUDING REDUCTION IN BOTH AIR AND WATER QUALITY AND IS RELEVANT TO WATER STUDIES CONCERNED WITH THE ROLE OF NON-MARKET EFFECTS IN WATER QUALITY MANAGEMENT. (W71-05951).

00301. SURVEY OF DESALTING PROCESSES FOR USE IN WASTE WATER TREATMENT.

SPIEWAK, I.

OAK RIDGE NATIONAL LABORATORY, TENN., ORNL-TM-3155, SEPTEMBER 1970, 30 P.

THIS REPORT IS BASED ON ONE OF A SERIES OF INVESTIGATIONS SPONSORED BY THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT TO DETERMINE THE BENEFITS WHICH MIGHT BE GAINED FROM URBAN ENERGY CENTERS. A REVIEW IS GIVEN OF PROCESSES WHICH APPEAR TO HAVE POTENTIAL FOR COMBINATION WITH DESALTING. A SURVEY OF DEVELOPMENTAL APPLICA-

TION OF DESALTING PROCESSES TO WASTES IS GIVEN. COST ESTIMATES ARE GIVEN FOR A NUMBER OF POSSIBLE SYSTEMS USING DESALTING TO TREAT EFFLUENT FROM A CITY OF 1 MILLION POPULATION. THE ANALYSIS INDICATES THAT, ALTHOUGH ADVANCED WASTE TREATMENTS MAY INCREASE THE COST OF SEWAGE PROCESSING BY FACTORS OF UP TO FOUR TIMES, THE OVERALL COST OF WATER SUPPLY, SEWERAGE AND TREATMENT NEED NOT BE INCREASED OVER ABOUT 30 PER CENT. IT IS CONCLUDED THAT DESALTING IS PRIMARILY OF VALUE IN SYSTEMS WHICH PROVIDE REUSABLE PRODUCT WATER. SUCH SYSTEMS GENERATE WASTE BRINES VERY DIFFICULT TO DISPOSE OF, IN MANY CASES, EXCEPT BY DISTILLATION TO DRYNESS. (ORNL-TM-3155) (W71-06268).

00302. ECONOMICS OF COMBINING DISTILLED SEAWATER AND RENOVATED WASTE WATER AS A NEW SOURCE OF MUNICIPAL WATER SUPPLY.

PORTER, J.W.

OFFICE OF SALINE WATER RESEARCH AND DEVELOPMENT REPORT NO 617, OCTOBER 1970.

A METHODOLOGY FOR DETERMINING THE PRELIMINARY ECONOMICS OF COMBINING DISTILLED SEAWATER AND RENOVATED WASTE WATER TO SERVE AS A NEW SOURCE OF MUNICIPAL WATER SUPPLY WAS INVESTIGATED AND THE RESULTED ARE REPORTED. A COMPUTATIONAL PROCEDURE FOR DETERMINING LEAST-COST SUPPLY FROM THIS COMBINED SOURCE AND ALTERNATIVE SINGLE SOURCES WAS DEVELOPED AND IS DOCUMENTED. THE FEASIBILITY OF THE COMPUTATIONAL PROCEDURE (A MATHEMATICAL MODEL) IS TESTED BY APPLICATION TO A HYPOTHETICAL U. S. COASTAL CITY. APPENDICES TO THE REPORT INCLUDE A DESCRIPTION OF THE STANDARD LINEAR PROGRAMMING MODEL (LP-600) USED, DISCUSSION OF THE NETWORK THEORY APPLIED, LISTINGS OF COMPUTER SUB-ROUTINES EMPLOYED, VERIFICATION OF COST CALCULATIONS AND A LIST OF CITED REFERENCES (GPO $1.50) (W71-06238).

00303. MARGINAL COSTS OF ALTERNATIVE LEVELS OF WATER QUALITY IN THE UPPER MISSISSIPPI RIVER.

LEWIS, R.L.

WATER RESOURCES RESEARCH CENTER, BULLETIN 25, UNIVERSITY OF MINNESOTA, MINNEAOLIS, MINNESOTA, SEPTEMBER 1970. 59 P.

THE PURPOSE OF THIS STUDY IS TO IDENTIFY THE PHYSICAL, INSTITUTIONAL AND ECONMIC INTERRELATIONSHIPS THAT AFFECT AND ARE AFFECTED BY THE QUALITY OF THE WATER IN THE MISSISSIPPI RIVER IN THE TWIN CITIES AREA. THE HYPOTHESIS TESTED IN THE THESIS IS THAT A COST MINIMIZING MANAGEMENT PLAN CAN BE DEVISED WHICH WILL MAINTAIN THE CURRENT DISSOLVED OXYGEN (DO) RIVER STANDARD IN THE STUDY AREA IN A MANNER THAT IS BOTH PHYSICALLY AND ECONOMICALLY FEASIBLE UNDER EXISTING CONDITIONS. (A MANAGEMENT PLAN IS ASSUMED TO BE ECONOMICALLY FEASIBLE IF THE INCREASE IN THE TOTAL ANNUAL COST OF TREATMENT DOES NOT EXCEED 10% OF THE PRESENT ANNUAL EXPENDITURE.) IF THE HYPOTHESIS IS ACCEPTED, THEN THE SEWER SERVICE BOARD COULD MAINTAN THE DO RIVER STANDARD AT A MODERATE INCREASE IN ANNUAL TREATMENT EXPENDITURE BY PROVIDING A MORE EFFICIENT ALLOCATION OF TREATMENT AMONG THE FIVE TREATMENT PLANTS. THE OBJECTIVES OF THE STUDY INCLUDE (1) IDENTIFY THE PHYSICAL, INSTITUTIONAL, AND ECONOMIC CONDITIONS RELATED TO WATER QUALITY, (2) PROPOSE AN ANALYTICAL FRAMEWORK FOR COMBINING THE PHYSICAL PROPERTIES OF THE RIVER WITH COSTS OF TREATMENT, (3) DETERMINE THE HIGHEST POSSIBLE DO RIVER STANDARD FEASIBLE WITH EXISTINT TREATMENT FACILITIES DURING SUMMER LOW FLOW; (4) TEST HYPOTHESIS THAT MINIMUM COST MANANGEMENT SCHEME CAN BE FOUND WHICH WILL MAINTAIN THE CURRENT DO RIVER STANDARD IN A MANNER BOTH PHYSICALLY AND ECONOMICALLY FEASIBLE UNDER EXISTING CONDITIONS. IT IS CONCLUDED THAT THE CHANGE IN THE INSTITUTIONAL STRUCTURE ADOPTED BY THE MINNESOTA LEAGUE WILL LEAD TO A MORE EFFICIENT ALLOCATION OF TREATMENT EXPENDITURES AT THE FIVE TREATMENT PLANTS. (W71-06191).

00304. WATER QUALITY TELEMETRY FINAL PROGRESS REPORT.

WOFFINDEN, D.S.; KARTCHNER, A.D.

UTAH WATER RESEARCH LABORATORY REPORT PRWG 3-2 COLLEGE OF ENGINEERING, UTAH STATE UNIVERSITY, AUGUST 1969. 42 P.

A BATTERY-POWERED RADIO-TELEMETRY METHOD FOR MONITORING WATER QUALITY HAS BEEN DEVELOPED BY THE UTAH WATER RESEARCH LABORATORY, OVERCOMING THE MAJOR DIFFICULTY OF LARGE, UNWIELDY SIZE. THE UTAH WATER RESEARCH LABORATORY'S UNIT IS SMALL ENOUGH TO BE HAND-CARRIED, BEING HOUSED IN A 15 IN. X 15 IN. X 14 IN. FIBERGLASS CASE. PHOTOGRAPHS ILLUSTRATE THE UNIT. A TECHNICAL DESCRIPTION IS GIVEN, INCLUDING CIRCUITRY, BLOCK DIAGRAMS OF THE FILED STATION AND BASE STATION, TRANSMITTER RECEIVER CONTROL AND POWER INTERCONNECTIONS, TIMER OPERATION, AND STATION REPLY TECHNIQUES. MEASUREMENTS OF DISSOLVED OXYGEN, TEMPERATURE, PH, AND CONDUCTIVITY CAN BE MADE AUTOMATICALLY, AND THE CIRCUITS FOR EACH OF THESE MEASURING DEVICES ARE OUTLINED. A TABLE ANALYZES COSTS OF BOTH FIELD AND BASE STATIONS, INCLUDING ASSEMBLY TIME AND LABOR COSTS. (W71-06069).

00305. STORMWATER OVERFLOW GETS BAGGED.

ENG NEWS-RECORD, 181(18), P 14, 1968.

THE FWPCA IS FINANCING PROJECTS TO INSTALL RUBBER STORMWATER STORAGE BAGS AT THREE LOCATIONS: WASHINGTON'S ANACOSTIA RIVER, SANDUSKY, OHIO AT LAKE ERIE, AND CAMBRIDGE, MD'S CHOPTANK RIVER ESTUARY. THE BAGS WILL STORE STORMWATER OVERFLOW THAT NORMALLY FLOWS UNTREATED INTO RIVERS AND LAKES ALONG WITH SANITARY WHEN FLOWS EXCEED TREATMENT PLANTS' CAPACITIES DURING HEAVY RAINFALL. THE WASHINGTON BAGS REST ON THE BOTTOM OF THE ANACOSTIA RIVER OFFSHORE OF THE PUMPING PLANT. THE PLATN WILL CHOP OVERFLOW SOLIDS BEFORE THE WATER REACHES THE BAGS, AND AN AERATOR WILL SUSPEND THE SOLIDS. THE SOLIDS COME OUT WITH THE STORED WATER WHEN IT IS PUMPED BACK INTO THE SEWERS FOR TREATMENT. THESE PLANS ARE CONSIDERABLY LESS COSTLY THAN SEWER SEPARATION WHICH WOULD COST AN ESTIMATED $48 BILLION TO ACCOMPLISH THROUGHOUT THE UNITED STATES. (W71-06341).

00306. ISLAND CITY SOLVES TOUGH SEWERAGE PROBLEM.

PUBLIC WORKS, 131(2), 95, 1970.

BY USING ARMCO STEEL CORPORATION'S DOUBLE-WALLED TRUSS PIPE, A GROUNDWATER INFILTRATION PROBLEM WAS ELIMINATED FROM GALVESTON'S SEWER SYSTEM. THE TRUSS PIPE CAN ALSO BE EASILY TAPPED

FOR HOUSE CONNECTIONS, AND ITS LOW INFILTRATION SPECIFICATIONS MAKE POSSIBLE AN ECONOMICAL DESIGN FOR FACTORY-BUILT TREATMENT PLANTS. CONSTRUCTION COSTS FOR SUCH PLANTS ARE INCLUDED, AS WELL AS DIMENSIONS OF THE EXTRA-STRENGTH PIPING. (W71-06346).

00307. CONSTRUCTION COST REQUIREMENTS FOR WATER AND WASTE WATER FACILITIES.

PUBLIC WORKS, 98(12), 112-113, 1967.

THE BUSINESSS DEFENSE SERVICES ADMINISTRATION SURVEYED 1200 MAJOR WATER UTILITIES IN ORDER TO PREDICT THE CONSTUCTION COST REQUIREMENTS FOR WATER AND WASTE WATER FACILITIES. THE FORECASTED AVERAGE ANNUAL EXEPNDITURE OVER THE 14-YEAR PERIOD (1967-1980) SHOWED A 139% INCREASE OVER ANNUAL AMOUNTS FOR THE PAST 12 YEARS. THESE EXPENSES RESULT FROM THE NEED TO REMEDY PRESENT DEFECTS, TO ACCOUNT FOR DEPRECIATION AND OBSOLESCENCE, AND TO COUNTER THE DEMANDS OF AN INCREASING POPULATION. DATA INCLUDED INDICATING COSTS REQUIRED FOR VARIOUS TYPES OF WATER SUPPLY AND WASTE WATER UTILITIES IN ADDITION TO AMOUNTS TO BE SPENT TO COMBAT INDIVDUAL PROBLEMS, CAN SERVE TO GUIDE MANUFACTURES IN PLANNING FUTURE CONSTRUCTION. (W71-06347).

00308. DEVELOPING RURAL HOME WATER SUPPLIES.

CANNELLA, A.A.
JOURNAL OF SOIL AND WATER CONSERVATION, 26(1), 30-31, 1971.

THE AUTHOR DESCRIBES THE ECONOMIC AND CONSTRUCTION DETAILS OF BUILDING A SURFACE WATER SUPPLY FOR AN INDIVIDUAL IN A RURAL AREA. THE AUTHOR EXPLAINS THAT IN AREAS WHERE GROUNDWATER IS HIGHLY CONTAMINATED BY CHEMICALS THE COST OF THIS SYSTEM COMPARES FAVORABLY WITH OTHER TYPES OF RURAL WATER SUPPLY. THE FILTRATION SYSTEM THAT HE DESCRIBES IS A SMALL-SCALE REPLICA OF A MUNICIPAL TREATMENT FACILITY WITH AN INITIAL COST OF APPROXIMATELY $1500. (W71-08823).

00309. NEW YORK'S HUDSON RIVER BEND COMPREHENSIVE SEWERAGE STUDY.

VONIC, M.; BUMSTEAD, J.C.
J WATER POLLUTION CONTROL FED., 41(4), 553-566, 1969.

THIS PAPER DESCRIBES A WORKABLE ENGINEERING FRAMEWORK OF A $26,000,000 PLAN FOR THE IMPLEMENTATION OF TWO TREATMENT PLANTS, ONE TO TREAT 32.5 MGD AND THE OTHR, 6.4 MGD OF COMBINED MUNICIPAL AND INDUSTRIAL WASTES, WHICH WOULD REDUCE AND CONTROL POLLUTION OF THE UPPER HUDSON RIVER. THE PLANTS WOULD SERVE 8 MUNICIPALITIES AND FOUR MAJOR INDUSTRIES (PAPER AND DYE) AROUND THE CITY OF GLEN FALLS. THE SIZE OF THE PLANTS IS THE RESULT OF A STUDY WHICH ESTIMATED THE POPULATION TO BE 100,000 BY YEAR 2000. THE STUDY ALSO ANALYZED THE RIVER FLOW AND INDICATED THE MAJOR PORTION OF THE WASTE LOADINGS TO BE OF AN INDUSTRIAL NATURE AND BASED ON BIOCHEMICAL OXYGEN DEMAND. THE EQUIVALENT POPULATION PRESENTLY AFFECTING THE STUDY AREA IS 550,000 - 9 TIMES THE ACTUAL POPULATION. THE REPORT RECOMMENDS A TRI-COUNTY SEWER DISTRICT AGENCY BE CREATED TO ADMINISTER THE PROPOSED SEWER DISTRICT ALLOCATING THE COST OF THE TREATMENT PLANT ON THE BASIS OF FLOW, BIOCHEMICAL OXYGEN DEMAND, AND SUSPENDED SOLIDS. (W70-07038).

00310. THE ECONOMIC IMPACT OF DROUGHT ON WATER SUPPLY SYSTEMS IN THE PASSAIC RIVER BASIN, NEW JERSEY.

HAVENS, A.V.
NEW JERSEY AGRICULTURAL EXPERIMENT STATION REPORT, DEC 1969, 125 P.

THE STUDY WAS CONFINED PRIMARILY TO ONE ADVERSE EFFECT OF THE 1961-1966 DROUGHT FOR WHICH GOOD QUANTITATIVE DATA WERE AVAILABLE. THE PASSAIC VALLEY COMMISSION SUPPLIES WATER TO A DENSELY POPULATED AND RATHER HEAVILY INDUSTRIALIZED SECTION OF NORTHEASTERN NEW JERSEY. THE EFFECT OF THE DROUGHT ON WATER QUALITY IN THE PASSAIC RIVER AT LITTLE FALLS AND THE SUBSEQUENT EFFECT ON THE WATER TREATMENT COSTS OF THE PASSAIC VALLEY WATER COMMISSION ARE THE PRINCIPAL SUBJECTS OF THIS STUDY. A CLOSELY RELATED INVESTIGATION OF DROUGHT PROBABILITY IS ALSO INCLUDED IN THE FINAL SECTION OF THIS REPORT. (PB-190 184) (W70-06960).

00311. CHICAGO WATER SYSTEM, A DESCRIPTION OF THE SYSTEM AND ITS SANITARY PROTECTION.

CITY OF CHICAGO DEPARTMENT OF WATER AND SEWERS, 1966.

THIS PAMPHLET DESCRIBES CHICAGO'S WATER SYSTEM AND ITS SANITARY PROTECTION. IN THE EARLY DAYS OF SETTLEMENT, CHICAGO DWELLERS DREW THEIR WATER SUPPLY DIRECTLY FROM THE CHICAGO RIVER AND LAKE MICHIGAN. AS THE POPULATION SERVED GREW FROM 178,500 AT THE END OF THE CIVIL WAR TO ITS PRESENT 4.6 MILLION IN THE METROPOLITAN AREA OF 402 SQUARE MILES, THE RIVERS AND LAKES HAVE BEEN POLLUTED AND VAST NETWORKS OF PUMPS, PIPES, SEWERS AND TREATMENT PLANTS HAD TO BE CONSTRUCTED TO MEET THE DEMANDS OF THE PEOPLE AND INDUSTRY. THUS, CHICAGO HAD DEVELOPED AND IS OPERATING ONE OF THE WORLD'S LARGEST WATER SUPPLY SYSTEMS. WATER IS NOW OBTAINED FROM LAKE MICHIGAN THROUGH TWO OF FOUR INTAKE CRIBS LOCATED TWO TO THREE MILES OFFSHORE, AND ONE SHORE INTAKE AT EACH OF THE TWO FILTRATION PLANTS. TEN PUMPING STATIONS, EACH HAVING 5 PUMPS, DELIVER MORE THAN ONE BILLION GALLONS PER DAY THROUGH 4,083 MILES OF PIPES. THE NEWER AND LARGER OF CHICAGO'S TWO FILTRATION PLANTS IS THE CENTRAL PLANT WHICH IS CAPABLE OF PRODUCING TREATED WATER AT A RATE OF 1.7 BILLION GALLONS PER DAY. IT WENT INTO OPERATION IN 1964 AND BECAME, BY FAR, THE LARGEST WATER TREATMENT PLANT IN THE WORLD. THE SOUTH PLANT, BUILT IN 1947, IS THE SECOND LARGEST PLANT IN THE WORLD. COST TO THE CONSUMER IS FIVE CENTS PER TON OF WATER. THIS IS THE CHEAPEST RATE OF ALL MAJOR CITIES IN THE UNITED STATES. (W70-06923).

00312. ALTERNATIVES FOR SLUDGE DISPOSAL, METROPOLITAN SYSTEM.

COLE, H.M. JR.
SAN DIEGO DEPT. OF UTILITIES, 1968, 85 P.

THE PROBLEMS AND ALTERNATIVES IN THE HANDLING AND DISPOSAL OF SEWAGE SLUDGE FROM THE SAN DIEGO METROPOLITAN SEWERAGE ARE DESCRIBED. SAN DIEGO HAS A CONTINUING PROBLEM OF FINDING SITES FOR SOLID WASTES DISPOSAL. FOR THE NEXT 10 YEARS THOUGH, THE CANYONS SURROUNDING MIRAMAR AIR

STATION WILL BE USED FOR SANITARY FILL OPERATIONS. ON THE BASIS OF COST FACTORS ONLY, THREE BASIC ALTERNATIVES THAT ARE SUITED TO THE SAN DIEGO AREA ARE COMPARED. THE CLASSIFICATIONS ARE: (1) OCEAN DISPOSAL (2) COMBUSTION AND ASH DISPOSAL, AND (3) LAND DISPOSAL OF LIQUID SLUDGE. IT WAS CONCLUDED THAT HAULING WASTES TO THE DESERT AND VARIOUS METHODS OF INCINERATION ARE EXPENSIVE AND SHOULD NOT BE CONSIDERED UNLESS AFTER ALTERNATIVES OF LAND AND OCEAN DISPOSAL PROVE TO BE UNACCEPTABLE. COMBUSTION OF SLUDGE HAS DISADVANTAGES. THE PRESENT METHOD OF SHIPPING WASTE TO FIESTA ISLAND IS HIGHLY DESIRABLE AND THE COST IS LOW, BUT MAY BE TERMINATED SOON. DISPOSAL TO THE OCEAN THROUGH AN OUTFALL IS ADVANTAGEOUS BUT IS NOT PERMITTED BY PRESENT POLICIES OF THE WATER QUALITY CONTROL BOARD. RESEARCH IS SUGGESTED. (W70-06916).

00313. LIFE AND HEALTH ASSURANCE.

GRIFFIN, G.E.
J WATER POLLUTION CONTROL FED., 43(7), 1292-1297, 1968.

RECENT DATA INDICATING TREATMENT PLANT ACCIDENT RATE ARE CITED AS BEING 7 TIMES GREATER THAN THAT FOR 41 MAJOR INDUSTRIES. SEVERAL SPECIFIC EXAMPLES OF POOR SAFETY PRACTICE ARE CITED, FOR EXAMPLE, LOW LEVEL BRIDGES WHERE SKULLS ARE CRACKED AND ELECTRICAL FIXTURES IN EXPLOSIVE AREAS NEAR DIGESTERS. DESIGN, OPERATION AND MAINTENANCE ALL PLAY VITAL ROLES IN ACHIEVING A GOOD SAFETY PROGRAM. A WELL-CONSTRUCTED SAFETY PROGRAM IS AN IMPORTANT AND NECESSARY PART OF ANY FACILITY IN ORDER TO PREVENT A LOSS OF LIFE, INJURY, AND TO KEEP LOSS OF WORK TIME AT A MINIMUM. DANGEROUS ACCIDENTS CAN BE AVOIDED BY EMPLOYING A WELL-DESIGNED, STRICTLY ENFORCED SAFETY PROGRAM. RECENT AWARENESS OF THE PROBLEM WILL IMPROVE THE SAFETY OUTLOOK. (W70-06900).

00314. DESIGN OF THE NEWTOWN CREEK WATER POLLUTION CONTROL PROJECT.

CUNETTA, J.; FEUER, R.
J WATER POLLUTION CONTROL FED., 40(4) 643-658, 1968.

THE INTERCEPTING SEWER SYSTEM FOR THE NEWTOWN CREEK PROJECT SERVES PORTIONS OF THE BURROUGHS OF MANHATTAN, BROOKLYN, AND QUEENS, AND COLLECTS FROM A DRAINAGE AREA OF 15, 389 ACRES. THE NEWTOWN CREEK TREATMENT PLANT UTILIZES HIGH-RATE ACTIVATED SLUDGE PROCESS, AND HAS A DESIGN CAPACTIY OF 310 MGD FROM AN ESTIMATED EQUIVALENT POPULATION OF 2,500,000. INCLUDED IN THE REPORT IS A DESCRIPTION OF THE AREA AND POPULATION SERVED, THE WASTE WATER TREATED, METHODS OF CONVEYANCE, RECEIVING WATER WAYS, PLANT SITE, AND TREATMENT UNITS USED. THE DIMENSIONS, CAPACITIES, AREAS, LOADINGS, REMOVAL CAPABILITIES, VOLUMES, OPERATING CONDITIONS, DETENTION TIMES AND OTHER PARAMETERS ARE TABULATED FOR EACH UNIT PROCESS. THE FACILITY INCLUDES GRIT CHAMBERS, AERATION TANKS, SEDIMENTATION TANKS, DIGESTERS, AND THE FACILITIES FOR HYPOCHLORINATION OF PLANT EFFLUENT. THE HIGH RATE ACTIVATED SLUDGE PROCESS IS DESIGNED TO ACHIEVE REMOVALS OF 70% OF THE SUSPENDED SOLIDS AND 60% OF THE BOD, BOTH OF WHICH ARE ESTIMATED AT 200 MG/L INFLUENT. A HIGH-RATE DIGESTION IS PROVIDED FOR THE SLUDGE PRIOR TO BARGING TO SEA. WHEN COMPLETED, THE NEWTOWN CREEK WATER POLLUTION CONTROL PROJECT WILL HAVE COST APPROXIMATELY $167,000,000. (W70-07711).

00315. CLOSED LOOP CHLORINATION FOR WASTE WATERS.

THOMAS, A.A.; BROWN, W.H.
J WATER POLLUTION CONTROL FED., 40(4), 684-688, 1968.

CLOSED LOOP CHLORINATION PROVIDES A RELATIVELY INEXPENSIVE METHOD BY WHICH ALL TREATMENT PLANTS CAN PROVIDE EFFECTIVE CHLORINATION. HARDWARE TO PROVIDE CHLORINATION CONTROL BY FLOW HAS BEEN AVAILABLE AND IN SATISFACTORY USE FOR MANY YEARS. IT COSTS APPROXIMATELY $5,000 AND REQUIRES MAINTENANCE AS DOES ANY INSTRUMENTATION EQUIPMENT. THESE INSTRUMENTS CAN REPLACE FOUR MEN REQUIRED TO MEASURE CHLORINE RESIDUALS AROUND THE CLOCK AND ACTUALLY COMPUTE CONTINUOUS CHLORINE RESIDUALS WHICH CAN BE RECORDED. THE INFORMATION FROM CHLORINE RESIDUAL INSTRUMENTS CAN BE RETURNED TO CONTROLS WHICH CHANGE THE RATE OF CHLORINE FEED TO THE WASTE WATER. THIS SYSTEM OF CONTINUALLY DETERMINING CHLORINE RESIDUAL AND CONTINUALLY ADJUSTING THE RATE OF CHLORINE FEED TO GET A PREDETERMINED CHLORINE RESIDUAL IS CALLED CLOSED LOOP CHLORINATION. THE LOOP IS FORMED BY FEEDING BACK UPSTREAM CONTROL INFORMATION. THE FUTURE EFFICIENCY OF TREATMENT EXPECTED WILL MAKE ACCURATE MANUAL CONTROL ALMOST IMPOSSIBLE, LEAVING CLOSED LOOP CHLORINATION THE ANSWER FOR ECONOMICAL AND EFFECTIVE CHLORINATION OF TREATED AND UNTREATED WASTE WATERS. (W70-07714).

00316. NEW PROCESS TO REMOVE PHENOLS FROM WASTE WATER.

LEWIS, W.L.
J WATER POLLUTION CONTROL FED., 40(5) PART 1, 869-872, 1968.

A PROCESS TO EXTRACT PHENOLS FROM CATALYTIC CRACKING DISTILLATE WATER RECENTLY WAS DEVELOPED BY HUMBLE OIL AND REFINING COMPANY. WITH A 12- X 40-FT ELECTROSTATIC TREATING DRUM, THIS EXTRACTION TECHNIQUE CAN REDUCE THE PHENOL CONTENT OF CAT-CRACKER DISTILLATE WATER UP TO 90%. THE WATER TREATED, CONDENSATE DISTILLED WATER, USUALLY CONTAINS MORE THAN 300 MG/L OF PHENOLS. BECAUSE OF THE VOLUME OF CONDENSATE WATER NORMALLY IS 5 TO 15% OF THE HYDROCARBON DISTILLATE VOLUME, THE TOTAL PHENOLS IN THE EFFLUENT WATER STREAM CAN AMOUNT TO SEVERAL HUNDRED POUNDS PER DAY. BY THOROUGHLY MIXING THE DISTILLATE WATER WITH CYCLE OIL AND THEN ALLOWING THE EMULSION TO SEPARATE, THE PHENOL PARTITIONS ITSELF BETWEEN THE TWO EMISSIONABLE LIQUIDS WITH MOST OF IT TRANSFERRING TO THE HYDROCARBON PHASE. PARTICLES BORUGHT ABOUT BY A 20,000 TO 40,000-VOLT POTENTIAL. THE INSTALLED COST OF THE DEVICE WAS LEE PROCESS CHOSEN FOR THE UNRECLAIMABLE PORTION OF THE WASTES WAS EXTENDED AERATSS THAN $200,000. (W70-07722).

00317. LAND RECLAMATION--A COMPLETE SOLUTION OF THE SLUDGE AND SOLIDS DISPOSAL PROBLEM.

DALTON, F.E.; STEIN, J.E.; LYNAM, B.T.
J WATER POLLUTION CONTROL FED., 40(5), 789-804, 1968.

THE WEST-SOUTHWEST PLANT OF CHICAGO HANDLES APPROXIMATELY 825 TONS/DAY OF SOLIDS. IN ORDER TO HANDLE THIS LOAD 4 METHODS ARE USED. (1) HEAT DRIED ACTIVATED SLUDGE PRODUCING APPROXIMATELY 435 TONS/DAY, (2) WET AIR OXIDATION PROCESS APPROX-

IMATELY 145 TONS/DAY, (3) HEATED DIGESTERS, 100 TONS/DAY, AND (4) IMHOFF TANK SLUDGE 145 TONS/DAY. TO THIS SHOULD BE ADDED 90 TONS/DAY FROM THE CALUMET PLANT MAKING A TOTAL OF OVER 900 TONS/DAY OF SLUDGE ON A DRY BASIS. THE SOLIDS DISPOSAL COST IS APPROXIMATELY 14.5 MILLION DOLLARS PER YEAR, OR 46% OF THE ANNUAL MAINTENANCE AND OPERATION BUDGET. A PROPOSED LAND RECLAMATION PLAN SATISFYING THE FOLLOWING CRITERIA IS REVIEWED. (1) IT MUST MEET ENVIRONMENTAL STANDARDS, NO AIR OR WATER POLLUTION, (2) IT MUST SOLVE THE PROBLEM INTO PERPETUITY, (3) THE METHOD SHOULD BE ECONOMICAL, AND (4) THE ORGANIC MATTER SHOULD BE CONSERVED FOR BENEFICIAL USE. IMPLEMENTATION OF THE RECLAMATION PLANT REQUIRES RESEARCH AND CAREFUL PLANNING. OF SPECIAL INTEREST IS THAT PORTION OF THE PLAN FOR LIQUID AS WELL AS SOLID DISPOSAL. SOME AREAS UTILIZING WASTE FOR LAND RECLAMATION ARE DOCUMENTED. (W70-07724).

00318. DESIGNS OF A MEAT PACKING WASTE TREATMENT PLANT.

WILLOUGHBY, E.; PATTON, V.D.
J WATER POLLUTION CONTROL FED., 40(1), 132-137, 1968.

A BRIEF DESCRIPTION IS GIVEN OF THE IN-PLANT ACTIONS TAKEN TO ELIMINATE THE SOURCES OF POLLUTION THROUGH THEIR RECLAMATION. FOR EXAMPLE, ALL THE VISCERA, HORNS, HOOVES, AND OTHER INEDIBLES WERE HASHED AND COOKED, AND THE GREASE RECLAIMED. THION MODIFICATION OF ACTIVATED SLUDGE. THE BASIC COMPONENTS OF THE SYSTEM AS DESIGNED AND INSTALLED INCLUDE A SEDIMENTATION AND GREASE SKIMMING FACILITY, EXTENDED AERATION, AND AEROBIC DIGESTION. THE AEROBIC DISGESTION SYSTEM CONSISTS OF TWO AERATION TANKS AND AN AEROBIC TANK, FINAL SETTLING TANK, WITH AN AIR-LIFT SLUDGE RETURN SYSTEM, 5-ACRE AEROBIC STABILIZATION POND, MULTI-STAGE AIR COMPRESSOR FACILITY, CHLORINATION FACILITY, AND DETENTION POND. TESTING OF COMPOSITE SAMPLES OVER A MONTH PERIOD INDICATED THAT. (1) THE BIOLOGICAL LOAD WAS ABOUT EQUAL TO THE DESIGN LOAD OF 2,000 LBS. BOD PER DAY, (2) THE HYDRAULIC LOAD WAS ABOUT 160% OF THE DESIGN BASIS OF 315,000 BAL/DAY, (3) BOD REMOVAL AVERAGED 84%, (5) SETTLEABLE SOLIDS REMOVAL AVERAGED 98%, (6) GREASE REMOVAL AVERAGED 98%. TOTAL COST OF THE FACILITY WAS ABOUT $250,000. (W70-07725).

00319. HYDRAULIC MODEL STUDIES OF CHLORINE MIXING AND CONTACT CHAMBERS.

LOUIE, D.S.; FOHRMAN, M.S.
J WATER POLLUTION CONTROL FED., 40(2), PART 1, 174-184, 1968.

BECAUSE OF THE SIZE AND COST OF THE PROPOSED POST-CHLORINATION FACILITY FOR METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO (330 MGD) IT WAS DECIDED THAT AN EXTENSIVE MODEL STUDY WOULD BE DESIRABLE. THE SCALE FINALLY DECIDED UPON WAS 1 TO 10, AND BECAUSE OF THE PHYSICAL LARGENESS OF THE MODEL, RESULTS WERE CONSIDERED TO BE MORE RELIABLE THAN USUALLY COULD BE EXTRAPOLATED FROM A MODEL TO PROTOTYPE. SINCE THE PROTOTYPE WAS TO CONSIST OF TWO SYMMETRICAL BATTERIES IT WAS NECESSARY TO MODEL ONLY ONE HALF OF THE PROTOTYPE. CONFETTI AND DYE WERE USED FOR VISUAL OBSERVATION OF MIXING IN THE MIXING CHAMBER AND DISTRIBUTION OF FLOW IN THE CONTACT CHAMBER. FIVER BASIC CONTACT CHAMBER SCHEMES WERE TESTED FOR THEIR COMPARATIVE PERFORMANCES FROM THE STANDPOINT OF FLOW PATTERNS, HEAD LOSS, AND DETENTION TIME. THE RESULTS OF THE STUDY ON THE MIXING CHAMBER AND DIFFUSER SYSTEM PROVIDED AN EFFECTIVE MEANS OF EVALUATING THE METHOD OF INTRODUCING AND MIXING CHLORINE WITH THE PLANT EFFLUENT. THE MOST EFFICIENT DESIGN FOR THE CONTACT CHAMBER WAS A VAN-BAFFLE SYSTEM. THE SCHEME WAS SUPERIOR FOR THE FOLLOWING REASONS. (1) IT HAD LOWEST HEAD LOSS OF ALL THE SCHEMES STUDIED. (2) IT HAD THE HIGHEST MINIMUM AND MEAN DETENTION TIME. (3) IT WAS THE MOST DESIRABLE OF ALL SCHEMES AS REGARDS SEDIMENTATION BECAUSE OF A MORE UNIFORM FLOW PATTERN. (W70-07726).

00320. FLOCCULATION OF BULK ACTIVATED SLUDGE WITH POLYELECTROLYTES.

SINGER, P.C.; PIPES, W.O.; HERMANN, E.R.
J WATER POLLUTION CONTROL FED., 40(2), PART 2, R1-R9, 1968.

BULK SLUDGE CAN BE FLOCCULATED AND CERTAIN CATIONIC POLYELECTROLYTES ARE FLOCCULANTS OF BULK ACTIVATED SLUDGE. THE OPTIMUM CONCENTRATION FOR THE TWO CATIONIC POLYMERS STUDIED WERE FOUND TO DEPEND ON THE INITIAL SLUDGE VOLUME INDEX AND ON THE SUSPENDED SOLIDS CONTENT. THE GREATER THE SUSPENDED SOLIDS CONCENTRATION, THE GREATER WAS THE POLYMER REQUIREMENT, AND THE GREATER THE FINAL SETTLED VOLUME. AS MORE POLYMER IS ADDED BEYOND THE POINT OF MAXIMUM FLOCCULATION, THE FLOC BECOMES LARGER RESULTING IN GREATER SETTLED VOLUME DUE TO TRAPPED WATER. THE USE OF CATIONIC POLYMERS IN FLOCCULATED BULK SLUDGE RESULTED IN THE DISCHARGE OF A CLEAR STABLE EFFLUENT AT DOSAGES OF BETWEEN 2 AND 3 MG/L. HOWEVER, IT WAS ALSO FOUND TO BE SUCCESSFUL AT A DOSAGE OF 50 MG/L. THE TREATMENT COSTS WERE: ALUM, $9.40/MILLION GALLONS; CATIONIC POLYMER A, $6.50/MILLION GALLONS; CATIONIC POLYMER B, $20.00/MILLION GALLONS. SLUDGE ONCE COAGULATED BY A POLYMER SEEMED RESISTANT TO SUBSEQUENT POLYMER COAGULATION DURING EXPERIMENTS OF RECYCLING OF SLUDGE. (W70-07727).

00321. USE OF COMPUTERS IN DESIGN OF SANITARY SEWER SYSTEMS.

DECICCO, P.R.; SOEHNGEN, H.F.; TAKAGI, J.
J WATER POLLUTION CONTROL FED., 40(2), PART 1, 269-284, 1968.

THE ELECTRONIC COMPUTER TECHNIQUES DEVELOPED FOR THE DESIGN OF MUNICIPAL SANITARY WASTEWATER COLLECTION SYSTEMS INCLUDE LINKED PROGRAMS FOR ESTIMATION OF DESIGN FLOW, DESIGN OF SEWERS, COMPUTATION OF PARTIAL FLOW CHARACTERISTICS, AND ESTIMATE OF COSTS. THE SYSTEM RECENTLY WAS APPLIED TO THE DESIGN OF MERRICK HARBOR COLLECTION DISTRICT SYSTEM IN NASSAU COUNTY, NEW YORK, WHICH HAS AN AREA OF ABOUT 5 SQ. MI. AND AN ULTIMATE POPULATION OF 39,500. THE PROGRAMS ARE APPLICABLE TO ANY AREA, REGARDLESS OF SIZE, TOPOGRAPHY, CONFIGURATION, OR OTHER SPECIAL CHARACTERISTICS. INPUTS INCLUDE BASIS FOR ESTIMATING DESIGN FLOWS, SEWER DESIGN CRITERIA, DEMOGRAPHIC, TOPOGRAPHIC AND GEOLOGIC DATA AND SEWER LAYOUT REQUIREMENTS. THE PROGRAM ALSO ACCEPTS INFORMATION ABOUT POTENTIAL OBSTRUCTIONS AND LOCATES SEWERS TO AVOID INTERFERENCE. THE COMPUTERIZED PROCEDURE IMPROVED BOTH QUALITY AND QUANTITY OF OUTPUT AND RELEASED ENGINEERING PERSONNEL FROM ROUTINE COMPUTATIONS. (W70-07732

REFERENCE LIST

00322. CENTRAL PRE-TREATMENT OF OMAHA PACKING HOUSE WASTE WATERS.

MEIER, E.B.; KORBITZ, W.E.
J WATER POLLUTION CONTROL FED., 40(4), 627-636, 19689.

THE DAILY KILL DAY DISCHARGES OF WASTE WATER FROM THE MEAT PACKING OPERATIONS IN THE CITY OF OMAHA AVERAGE MORE THAN 15 MILLION GALLONS AND CONTAIN AT LEAST 70 DRY TONS OF SUSPENDED SOLIDS IN ADDITION TO APPROXIMATELY 25-40 DRY TONS OF ANIMAL FAT. THE SUSPENDED SOLIDS ARE PREDOMINANTLY KILL FLOOR SCRAPS AND PAUNCH MANURE FROM CATTLE, HOGS, AND SHEEP. THE SIMPLE AND INEXPENSIVE METHOD OF PAUNCH MANURE AND GREASE DISPOSAL BY SLUICING FROM THE PREMISES IS NO LONGER ACCEPTABLE. THE DIFFICULTY OF OWNING AND OPERATING PRIVATELY 18 SEPARATE FACILITIES WOULD BE DIFFICULT IF NOT IMPOSSIBLE. THE CITY AND INDUSTRY JOINED HANDS IN AN EFFORT TO FIND AN ECONOMICALLY FEASIBLE SOLUTION. THE FINAL SOLUTION INVOLVED THE DESIGN OF COLLECTOR SEWER SYSTEMS, GRAVITY SETTLING BASINS, CONVENTIONAL DEWATERING AND CONVEYING FACILITIES, AIR FLOTATION UNITS, SOLIDS AND SKIMMINGS STORAGE, AND A CONTINUOUS DEHYDRATION SYSTEM FOR SKIMMINGS USING OIL AS A PROCESS VEHICLE. THE PRE-TREATED WASTE WATER WILL BE DISCHARGED TO THE CITY SEWERS. TOTAL ESTIMATED COST OF THE OMAHA PLANT IS 6.7 MILLION DOLLARS AND WILL BE FINANCED CHIEFLY BY BONDS. THE BONDS WILL BE FUNDED FROM REVENUES DERIVED FROM THE SALE OF PROCESSES GREASE RECOVERED FROM THE TWO-STAGE FACILITY, AND BY PAYMENTS FROM INDIVIDUAL PACKING COMPANIES. (W70-07807).

00323. CHEMICAL PROCESSING OF WASTE WATER FOR NUTRIENT REMOVAL.

ELIASSEN, R.; TOHOBANOGLOUS, G.
J WATER POLLUTION CONTROL FED., 40(5), PART 28 R171-R180, 1968.

NUTRIENT REMOVAL METHODS CAN BE CLASSIFIED AS BIOLOGICAL, CHEMICAL AND PHYSICAL. CHEMICAL METHODS FOR THE REMOVAL OF NITROGEN INCLUDE; AMMONIA STRIPPING, ION EXCHANGE, AND ELECTROCHEMICAL TREATMENT. CHEMICAL PRECIPITATION, ION EXCHANGE, SORBTION, AND ELECTRO-CHEMICAL TREATMENT ARE ALSO AVAILABLE FOR REMOVAL OF PHOSPHORUS. TYPICAL REMOVAL EFFICIENCIES ARE 80-98% NITROGEN AND 85-99% FOR PHOSPHORUS. THE KEY FACTORS IN PLANNING AND DESIGNING NUTRIENT REMOVAL FACILITIES ARE THE NUTRIENTS TO BE REMOVED, THE USE OF TREATED WASTE WATER, MEANS FOR ULTIMATE DISPOSAL OF CONTAMINANTS, AND ECONOMIC FEASIBILITY. COSTS FOR DIFFERENT PROCESSES VARY WIDELY. FOR EXAMPLE, SOIL SPREADING VARIES BETWEEN $0.001 TO $0.3/1000 GAL. WHILE DEEP-WELL INJECTION VARIES BETWEEN $13 AND $27/1000 PHOSHPORUS REMOVAL VARIES BETWEEN $40 AND $70 PER MILLION GAL. (W70-07810).

00324. DESIGN AND OPERATION OF THE FIRST DIGESTER GAS TURBINE IN THE U.S.A..

HUNT, H.H.; CLARKE, W.N. SR.
J WATER POLLUTION CONTROL FED., 40(7), 1346-1357, 1968.

THE GAS TURBINE NOW IN OPERATION AT THE COUNTY SANITATION DISTRICTS OF ORANGE COUNTY, CALIFORNIA, IS THE FIRST IN THE UNITED STATES AND THE SECOND IN THE WORLD TO UTILIZE WASTE DIGESTER GAS AS A FUEL. THE PAPER PRESENTS THE THINKING AND DECISIONS WHICH LEAD TO THE TURBINE SYSTEM'S DESIGN, INSTALLATION AND OPERATION. THE TURBINE GENERATOR IS SUITED IDEALLY FOR PEAKING AND STAND-BY POWER GENERATION AS IT IS NOT NECESSARY TO START A BOILER AND WAIT FOR TEAM GENERATION BEFORE POWER CAN BE PRODUCED. ALSO THE TURBINE REQUIRES MUCH LESS SPACE THAN THE DIESEL ENGINE. THE UNIT IS LIGHTWEIGHT AND CAN PRODUCE 70 TO 140 KILOWATTS OF ELECTRICAL ENERGY PER TON OF TOTAL MACHINERY AS COMPARED TO 27 KILOWATTS PER TON WITH THE DIESEL ENGINE. ONE OF THE BIGGEST ADVANTAGES OF THE GAS TURBINE IS THAT NO WATR IS NEEDED FOR EITHER COOLING OR POWER, WITH THE EXCEPTION OF WATER REQUIRED TO COOL THE GAS. THE TURBINE PURCHASED IS A DUAL FUEL TYPE RATED AT 1080 KILOWATTS, AND DRIVES A SYNCHRONOUS BRUSHLESS ALTERNATING CURRENT GENERATOR RATED AT 1000 KILOWATTS. THE EXHAUST GAS FROM THE TURBINE PASSES THROUGH A HEAT RECOVERY UNIT WHICH HAS A STEAM CAPACITY RATING OF 12,000 POUNDS PER HOUR. THE STEAM FROM THIS UNIT DRIVES A STEAM TURBINE WHICH IN TURN DRIVES A 300 KILOWATT INDUCTION GENERATOR. THE INITIAL COST OF THE ABOVE EQUIPMENT WAS $258,000. COST FOR INSTALLATION WAS $261,000. (W70-07813).

00325. EFFECT OF PRIMARY EFFLUENT SUSPENDED SOLIDS AND BOD ON ACTIVATED SLUDGE PRODUCTION.

VOSHEL, D.; SAK, J.G.
J WATER POLLUTION CONTROL FED., 40(5), PART 2, R203-R212, 1968.

THE GRAND RAPIDS WATER POLLUTION CONTROL PLANT WAS CONSTRUCTED IN 1929, AND CONSISTED OF A PRIMARY PLANT ONLY. IN 1953 THE PLANT WAS EXPANDED TO INCLUDE THEACTIVATED SLUDGE PROCESS, AND AGAIN IN 1958 IT WAS EXPANDED MORE. THE PRIMARY EFFLUENT SUSPENDED SOLIDS LEVEL WAS OBSERVED TO HAVE A MAJOR INFLUENCE ON THE TOTAL WEIGHT OF EXCESS SLUDGE PRODUCTION. THE PRIMARY EFFLUENT SUSPENDED SOLIDS CAN BE CONTROLLED BY ADDITION OF AN ORGANIC FLOCCULANT TO THE RAW WASTE WATER STREAM. APPROXIMATELY 1 MG/L OF ANIONIC POLYMER WAS ADDED TO THE RAW WASTE WATER AHEAD OF THE GRIT CHANNEL. LITTLE FLOCCULATION OCCURRED IN THE GRIT CHANNEL, BUT TURBULENCE AT THE PROPORTIONAL WEIRS OF THE CHANNEL EXIT PROVIDED EXCELLENT MIXING. THE RESULTING FLLOCULATION REMOVED A GREATER PORTION OF BOD THAN IS REMOVED NORMALLY ACROSS THE PRIMARY CLARIFIER. ADDITIONAL REMOVAL OF SUSPENDED SOLIDS AND BOD ACROSS THE PRIMARIES RESULTED IN REDUCTION OF EXTRA SLUDGE. PRIMARY EFFLUENT SUSPENDED SOLIDS DROPPED FROM 112 MG/L TO 45 MG/L. THE PRIMARY EFFLUENT BOD DROPPED FROM 77 MG/L TO 54 MG/L. EXCESS ACTIVATED SLUDGE PRODUCTION WAS REDUCED FROM 34,000 LBS/DAY TO 13,500 LBS/DAY. SAVINGS IN THE PLANT OPERATING COSTS RESULTED FROM REDUCTION OF AERATION AIR REQUIRMENTS, DECREASE IN CHLORINE DEMAND AND IMPROVED FILTERABILITY OF THE SLUDGE. THE FINAL EFFLUENT QUALITY ALSO IMPROVED. (W70-7814).

00326. DESIGN AND OPERATION OF LARGE DESALTING PLANTS.

BAKER, R.A. JR.
WATER AND WASTE TREATMENT 12(11), 356-360, 1970.

THE PRESENT STATE AND FUTURE OUTLOOK FOR LARGE WATER DESALTING PLANTS WERE EXAMINED USING AD-

VANCES IN SIZE AND EFFICIENCY CREATED OVER THE PAST TWELVE YEARS. AMERICAN INDUSTRY HAS MADE THESE IMPRESSIVE CONTRIBUTIONS TO WATER DESALTING. YET LARGER PLANTS THAT REALIZE THE FIELD ECONOMY OF SIZE AVAILABLE FROM A PROVEN TECHNOLOGY (I. E. FLASH DISTILLATION) TO REDUCE COST OF WATER FOR UNDERDEVELOPED AREAS, ARE NEEDED. THE KUWAIT LAND-BASED DESALTING PLANT BUILT IN 1957 BY WESTINGHOUSE WAS CITED AS AN EXAMPLE OF FLASH DISTILLATION. THE BASICALLY SIMPLE DESIGN INVOLVED FOUR STAGES. HOLDING DOWN THE FIRST COST WAS MORE IMPORTANT IN THIS CASE THAN DESIGNING FOR HIGH OPERATING EFFICIENCY. SINCE 1957 WHEN THE FIRST KUWAIT PLANT WENT INTO OPERATION, THREE MORE WERE PUT INTO OPERATION IN 1968. THEY PRODUCE WATER FOR ONLY A FRACTION OF THE COST ATTAINED IN THE FIRST LARGE DESALTING PLANT. ANOTHER PLANT BUILT AT POINT LOMA, NEAR SAN DIEGO, CALIFORNIA WAS DESIGNED FOR EFFICIENCY. IT HAD THIRTY-SIX STAGES AND OPERATED IT WITH EITHER OF TWO SCALE CONTROL SYSTEMS. ANOTHER BUILT AT THE GUANTANAMO BAY NAVAL BASE IN CUBA WAS A DUAL PURPOSE WATER-DESALTING PLANT AND OPTIMIZED FULL EFFICIENCY AS WELL AS HELD DOWN CAPITAL COST. OTHER PLANTS WERE DESCRIBED WHICH DEMONSTRATED CONTINUING CHANGE FOR EFFICIENCY AND ECONOMY. THE OPTIMUM LARGE PLANTS OF THE FUTURE MAY INCORPORATE OTHER TECHNOLOGIES OF FLASH DISTILLATION, AND THUS PRODUCE NOT ONLY MULTIPLE QUALITIES OF WATER, BUT ALSO REPROCESS THAT WATER FOR RE-USE. (W70-07854).

00327. NEW PROCESS FOR THE TREATMENT OF EFFLUENTS IN THE TEXTILE INDUSTRY (IN GERMAN).

ZIETSCHRIFT FUR DIE GESAMTE TEXTILE INDUSTRIES, 64(4), 299-304, 1962.

A NEW PROCESS WHICH DISPENSES WITH THE NEED FOR A LARGE STORAGE VESSEL AND IS THUS PARTICULARLY RECOMMENDED FOR INDUSTRIAL CONCERNS IN HIGHLY BUILT-UP AREAS CONSISTS IN THE ADDITION OF A FLOCCULATION AGENT TO AN INTENSE AERATION OF THE IMPURITIES AS A SURFACE SKIN WHICH CAN BE EASILY REMOVED BY ADSOR EFFLUENT WITH SIMULTANEOUS PH ADJUSTMENT. THIS PRECIPITATES SOLID AND COLLOIDALPTION INTO ARTIFICIAL RESINS. TYPICAL LAYOUTS FOR THE TREATMENT PLANT ARE SHOWN AND COSTS ARE DISCUSSED. (W70-07961).

00328. SIMPLE BIO-AERATION KILLS STRONG WASTES CHEAPLY.

RIDGWAY, F.

CHEMICAL ENGINEERING, 70(1), 40-41, 1963.

A NEW BIO-AERATION SYSTEM, BASED ON ACTION OF MICROORGANISMS IN A ONE-STAGE, PROLONGED PROCESS, IS HELPING TEXTILE MILLS REMOVE UP TO 90 PERCENT OF BIOCHEMICAL OXYGEN DEMAND FROM STRONG STARCH DESIZING WASTES. DEVELOPED BY R. H. SOUTHER, GREENSBORO, NORTH CAROLINA, THE PROCESS HAS FOUR MAJOR ADVANTAGES: (1) LOWER OPERATONAL COST, (2) ELIMINATION OF PRIMARY SETTLING TANKS AND ANAEROBIC SLUDGE DIGESTERS, (3) DECREASES IN THE ADVERSE EFFECT FROM VARIABLE FLOW, CHANGES IN PH, AND SHOCK ORGANIC LOADINGS IN TREATMENT OF SEWAGE AND NON-TOXIC ORGANIC WASTES, AND (4) INCREASED FLEXIBILITY IN THE USE OF AIR TO OBTAIN DESIRED EFFLUENT CHARACTERISTICS. WASTE WATER PASSES THROUGH A BAR SCREEN AND A MEASURING DEVICE INTO AN AERATION TANK, THEN THROUGH BAFFLES TO A FINAL SETTLING TANK, AND FINALLY OVER WEIRS TO THE RECEIVING STREAM. SLUDGE IS RETURNED TO THE INFLUENT END OF THE AERATION TANK TO OBTAIN HIGHEST BOD EFFICIENCY. OPERATING COSTS AVERAGE 0.6 CENTS PER POUND OF BOD INFLUENT PER DAY, ABOUT 33 PERCENT LESS THAN THE COST FOR A CONVENTIONAL TREATMENT PLANT. (W70-07964).

00329. ECONOMICAL UTILIZATION OF CAUSTIC SODA IN COTTON BLEACHERIES.

STEELE, W.R.

AMERICAN DYESTUFF REPORTER, 51(1), 29-30 1962.

PROCEDURES HAVE BEEN DEVELOPED FOR INCREASING THE QUANTITY AND CONCENTRATION OF RECOVERED CAUSTIC SODA LIQUOR TO PERMIT REUSE OF THE MAXIMUM AMOUNT OF CAUSTIC SODA WITHOUT RECONDITIONING. IF THE CONCENTRATION OF CAUSTIC USED LIQUOR IS NOT TOO LOW, IT CAN BE EVAPORATED, PURIFIED, AND REUSED. BECAUSE IMPURITIES MUST BE CONCENTRATED BEFORE EVAPORATION, FILTRATION IS REQUIRED. SOMETIMES, DIALYSIS IS NECESSARY TO REDUCE SOLUBLE IMPURITY CONTENT. A CAUSTIC REUTILIZATION SURVEY MAY SHOW THAT, ALTHOUGH COLLECTION, FILTRATION, EVAPORATION, DIALYZATION, AND RE-EVAPORATION MAY BE NEEDED, ANNUAL COST SAVINGS MAY EXCEED 50 PERCENT. BENEFICIAL SIDE EFFECTS SUCH AS INCREASED YARDAGE RETURN AND ALLEVIATION OF WATER AND AIR POLLUTION MAY ALSO BE OBTAINED. (W70-07965).

00330. TEXTILE WATER POLLUTION CLEANUP PICKS UP SPEED.

PINAULT, R.W.

TEXTILE WORLD, 117, P52-66, 1967.

IT IS ESTIMATED THAT THE TEXTILE INDUSTRY WILL BE REQUIRED TO SPEND $350 MILLION DOLLARS IN THE NEXT 10 YEARS TO REDUCE THE POLLUTION FROM THEIR PLANTS TO AN ACCEPTABLE LEVEL. FOR A PLANT DYEING AND FINISHING 150 MILLION YARDS OF FABRIC A YEAR, AN ADDED COST MAY BE ABOUT ONE-TENTH OF A CENT PER YARD. THE OPERATION OF FIVE PLANTS ARE DESCRIBED. THESE ARE: (1) PLANT FOR THE DYEING AND BLEACHING OF TRICOT FABRIC MADE FROM MAN-MADE FIBERS, (2) A PLANT WHERE COLOR IS REMOVED BY TREATING WITH LIME AND SETTLING IN A LAGOON, (3) A PLANT WHERE COLOR WAS NOT A PROBLEM AND USES AERATION LAGOONS, (4) A PRINTING AND FINSIHING PLANT USING 9 TO 10 MILLION GALLONS OF WATER PER DAY, AND (5) A MILL WHICH CAN DISCHARGE ITS WASTE WATER, AFTER TREATMENT, INTO A LARGE FRESH WATER LAKE. (W70-07979).

00331. ULTRASONIC EMULSIFICATION OF OIL TANKER CARGO, TO REDUCE OIL SLICK HAZARDS IN EVENT OF SPILLAGE AT SEA.

WATER POLLUTION CONTROL RESEARCH SERIES, APR 1970. 164 P.

THE PURPOSE OF THIS PROJECT WAS TO STUDY THE FEASIBILITY OF PRODUCING EMULSIFIED OIL AT A RATE COMPARABLE WITH CONVENTIONAL TANKER LOADING RATES AND TO INVESTIAGATE THE ECONOMIC AND ECOLOGICAL FACTORS. TO DETERMINE BLENDER PARAMETERS AND EMULSIFIED OIL CHARACTERISTICS, TWO CRUDE OILS AND ONE FUEL OIL WERE CHOSEN. A LIBYAN LIGHT OIL, A VENEZUELAN OIL AND NO. 6 FUEL OIL WERE USED. ONLY TWO EMULSIFIERS WERE USED AND THEY WERE BASE-NEUTRALIZED SULFONATED NONIONICS. THESE ARE COMPATIBLE WITH SEA WATER AND OF LOW TOXICITY. THE EMULSIONS TESTED WERE

OIL-IN-WATER. OIL WAS THE INTERNAL PHASE AND 97% OF THE TOTAL. WATER AND CHEMICAL WAS TE EXTERNAL PHASE AND 3% OF THE TOTAL. THE TESTS ON THE EMULSIONS WERE TO DETERMINE: STABILITY UNDER SIMULATED TRANSPORTATION CONDITIONS, DISPERSIBILITY IN SEA WATER, TOXICITY TO FISH, AND PRODUCT ALTERATION. INCLUDED WERE TESTS WITH SAFETY ASPECTS. EVAPORATION RATES, FLASH POINTS, VAPOR PRESSURES AND RUPTURE LEAK TESTS. AN ECONOMIC STUDY WAS MADE WHICH SHOWS EMULSIFICATION COSTS OF ABOUT 20 CENTS PER BARREL WITHOUT CONSIDERING POSSIBLE OFFSETS OR SIDE BENEIFTS. (PB-192 633) (W70-07996).

00332. THERMAL EFFECTS: A REPORT OF UTILITY ACTION.

OLDS, F.C.
POWER ENGINEERING, 74(4), 26-31, 1970.

THE RESULTS OF A THERMAL DISCHARGE SURVEY CONDUCTED BY POWER ENGINEERING ARE DESCRIBED. THE SURVEY INCLUDED 43% OF ALL UTILITIES IN THE U. S. WITH 8-MW OR MORE OF STEAM-ELECTRIC GENERATING CAPACITY. DATA DEALING WITH PERCENT OF RETURN AND TYPE OF UTILITY IS LISTED IN TABULAR FORM. THE RESULTS INDICATED THAT 123 UTILITIES OF THE 135 UTITLITES REPORTING MAY NOT BE IN COMPLIANCE WITH EXISTING STANDARDS. MOREOVER, COMPANIES WITH HIGHER CAPACITIES ARE NOT IN COMPLIANCE AS MUCH AS THOSE WITH LOWER CAPACITIES. FURTHER, THE SURVEY SHOWED A TENDENCY FOR UTILITIES TO CHANGE FROM DIRECT DISCHARGE TO COOLING TOWERS FOR THEIR NEXT PLANTS. TWENTY COMPANIES ESTIMATE THAT THEY WILL SPEND 157 MILLION DOLLARS ON NEW PLANTS TO ENSURE THAT THEY MEET NEW WATER TEMPERATURE STANDARDS. FROM THIS ANALYSIS, FOUR MAJOR ASPECTS OF TEMPARATURE COMPLIANCE STAND OUT CLEARLY. THEY INCLUDE: (1) TEMPERATURE STANDARDS ARE A MOVING TARGET; (2) MIXING ZONES ARE UNDEFINED, (3) UPPER TEMPERATURE LIMITS ARE RIGIDLY AND CAPRICIOUSLY SET; AND (4) AS STANDARDS BECOME MORE STRINGANT, COSTS SKYROCKET. (W70-08122).

00333. DISPERSED GROWTH AERATION OF COTTON FINISHING WASTES. II. EFFECT OF HIGH PH AND LOWERED AIR RATE.

NEMEROW, N.L.
AMERICAN DYESTUFF REPORTER, 46(16), 575-576, 1957.

BY REDUCING THE AMOUNT OF AIR AND ELIMINATING CARBON DIOXIDE USED IN THE AERATION AND NEUTRALIZATION OF HIGHLY ALKALINE WASTE WATER FROM 1 COTTON SCOURING AND MERCERIZING OPERATION, A CONSIDERABLE DOLLAR SAVING WAS EFFECTED. BUT IN SO DOING THE REDUCTION IN THE B. O. D. OF THE DISCHARGED WATER DROPPED FROM 71 PERCENT TO 33.6 PERCENT. (W70-08138).

00334. COMPREHENSIVE STUDY ON PROTECTION OF WATER RESOURCES OF LAKE TAHOE BASIN THROUGH CONTROLLED WASTE DISPOSAL.

MCGAUHEY, P.H.; ELIASSEN, R.; ROHLICH, G.; LUDWIG, H.F.; PEARSON, E.A.
LAKE TAHOE AREA COUNCIL, CALIFORNIA, JUNE 1963, 163 P.

THE LAKE TAHOE SHORE DEVELOPMENT FOR RECREATIONAL PURPOSES, ONE OF THE WORLD'S CLEAREST LAKES, HAS INCREASED RESIDENT HUMAN POPULATION AND SUBJECTED IT TO AGGREVATED EUTROPHICATION INFLUENCES. THIS DETAILED BASE LINE STUDY WAS UNDERTAKEN TO DETERMINE RESOURCES OF BASIN, EVALUATE ITS PRESENT STATUS, AND SUGGEST PROGRAMS TO AVOID FURTHER DETERIORATION. TOPICAL COVERAGE OF 16 CHAPTERS INDICATES ITS SCOPE: INTRODUCTION; GEOGRAPHY OF BASIN; CLIMATOLOGY AND HYDROLOGY; GEOLOGY AND HYDROLOGY; LAND USE PATTERNS; POPULATION FORECASTS; WATER CONSUMPTION; EXISTING SEWERAGE FACILITIES; QUANTITY AND CHARACTERSTICS OF WASTES; GROUND DISPOSAL STUDIES; LIMNOLOGY AND HYDROGRAPHY OF LAKE TAHOE, LACUSTRINE EUTROPHICATION; METHODS OF EFFLUENT DISPOSAL; DESIGN CRITERIA AND COST ESTIMATING BASES; ALTERNATIVE TREATMENT AND DISPOSAL SYSTEMS; SUMMARY AND CONCLUSION. NINE APPENDICES INCLUDE: LIST OF FIGURES; PROPOSED COMPACT TERMS FOR TAHOE BASIN; GLOSSARY OF LIMNOLOGICAL TERMS; ANALYTICAL METHODS USED; TEMPERATURE MEASUREMENTS; MICROPLANKTON ANALYSIS; CHEMICAL CHARACTERSTICS; PERIPHYTIC MICROORGANISMS; PRIMARY PRODUCTIVITY MEASUREMENTS. THESE STUDIES SUGGEST THAT LAKE TAHOE IS VERY SENSITIVE TO ADDITIONS OF PLANT NUTRIENTS, AND THAT ADDITIONAL NITROGEN WILL BE MORE DAMAGING TO ITS WATER QUALITY THAN PHOSPHORUS. IDEALLY, CONTROL OF EUTROPHICATION SHOULD BE ACCOMPLISHED BY DIVERSION OF EFFLUENTS FROM THE LAKE, OR BY DISTILLATION OF SECONDARY EFFLUENTS--AT GREAT EXPENSE. (W70-05615).

00335. INDUSTRIAL WATER RECIRCULATION IN NORTHEASTERN ILLINOIS.

SASMAN, R.T.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 62(5), 269-273, 1970.

A NUMBER OF INDUSTRIES, COMMERCIAL COMPANIES, AND SERVICE ORGANIZATIONS ARE PARTICIPATING IN PROGRAMS OF WATER RECIRCULATION IN NORTHEASTERN ILLINOIS. CHEMICAL AND METAL PROCESSING INDUSTRIES ARE DOING THE MOST RECIRCULATING AND FOOD PROCESSORS ARE DOING VERY LITTLE. SIXTEEN SYSTEMS REDUCED TOTAL PUMPAGE AN AVERAGE OF APPROXIMATELY 47 PERCENT. PRIMARY REASONS PRESENTED FOR RECIRCULATING WATER INCLUDED A CONCERN FOR THE AVAILABILITY OF THE WATER, THE COST OF WATER, AND RECENT REGULATIONS REGARDING WATER QUALITY STANDARDS FOR SURFACE WATERS RECEIVING WASTE WATER EFFLUENT. (W70-08228).

00336. FEDERAL GRANTS FOR MUNICIPAL WASTE TREATMENT--THE NEED FOR POLICY CHANGE.

ELLIS, J.R.
J WATER POLLUTION CONTROL FED., 42(5), PART 1, 679-684, 1970.

THE BIGGEST PROBLEMS ARE IN BIG CITIES; HOWEVER, THE LARGE METROPOLITAN AREAS HAVE BEEN NEGLECTED SADLY BY THE FEDERAL GOVERNMENT AND IT IS TIME TO SHIFT THE BALANCE. THIS CAN BE DONE BY ADOPTING SIX CHANGES IN OUR FEDERAL POLICY. (1) REDRESS THE LARGE CITY INEQUITY BY AUTHORIZING INCENTIVE GRANTS FOR QUALIFYING NEW PROJECTS. (2) MAKE COMBINED SEWER OVERFLOW ABATEMENT FACILITIES ELIGIBLE FOR FEDERAL GRANTS. (3) MAKE THE FEDERAL GRANT COMMITTMENT RELIABLE AS TO RECEIPT AND ADEQUATE AS TO DOLLARS. (4) STRENGTHEN THE MARKET FOR LOCAL BONDS BY RENOUNCING THE ABORTIVE EFFORT TO TAX MUNICIPAL BONDS BY REDRESSING THE SUPPLY-DEMAND EQUATION

BY SUBSTANTIAL FEDERAL SUPPORT. (5) DEVELOP REGULATORY STANDARDS WHICH ENCOURAGE LOCAL COMMUNITIES TO DIRECT THEIR WORST LOCAL PROBLEMS AND WHICH WILL GET THE MOST POLLUTION ABATEMENT FOR EACH FEDERAL AND LOCAL TAX DOLLAR. (6) ENCOURAGE THE LOCAL USE OF SEWER SERVICE CHARGES BY OFFERING A FEDERAL GRANT INCENTIVE, BUT DO NOT PERMIT ANY INDUSTRY TO DESTROY ANY STREAM FOR A FEE. (W70-08297).

00337. OXNARD SEWAGE PLANT SOLVES ODOR CONTROL PROBLEM.

PATEMAN, S.G.
WATER SEWAGE WORKS, 116(10), 352-353. 1969.

THE OXNARD WASTE TREATMENT PLANT HAS SOLVED AN EXTREMELY DIFFICULT ODOR CONTROL PROBLEM WHICH RESULTED FROM THE TREATMENT OF FARM PRODUCE PROCESSING WASTES. THE SYSTEM CONSISTS OF FOG SPRAY NOZZLES WHIXH DISTRIBUTE A SERIES OF MALABATE REODORANTS. THE MALABATES CHEMICALLY TREAT THE ODORS, NOT JUST MASK THEM WITHOUT RAISING THE ODOR LEVEL. THE MALABATE REODORANTS DO NOT CORRODE NOZZLES OR PUMPS. TOTAL INSTALLATION COST OF THE COMPLETE SYSTEM WAS LESS THAN $3,200 AND CHEMICAL COSTS AVERAGE LESS THAN $3.50 PER DAY. THE SYSTEM IS USED ONLY 6 TO 8 HOURS PER DAY. (W70-08298).

00338. UNIT PROCESS PERFORMANCE MODELING AND ECONOMICS FOR CANNERY WASTE TREATMENT.

PARKER, D.S.; MONSER, J.R.; SPICER, R.G.
PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 23RD, MAY 1968. P 710-739.

DATA FROM SEVERAL UNIT PROCESSES WAS ANALYZED WITH REFERENCE TO ONE PARTICULAR CANNERY WASTE FOR THE DEVELOPMENT OF OPTIMAL DESIGN CRITERIA. DUE TO THE NATURE OF THE DATA, THE INPUT REQUIREMENTS FOR THE SYSTEM DESIGN PROCEDURE WERE TERMED COST-SIZE-EFFICIENCY (C-S-E) RELATIONSHIPS. TWELVE ALTERNATIVE UNIT PROCESSES ARE ANALYZED INCLUDING: ACTIVATED SLUDGE, LAGOONS AND CHEMICAL WASTE TREATMENT SYSTEMS. IN THE SYSTEM OPTIMIZATION ANALYSES, THE C-S-E RELATIONSHIPS WERE USED TO DETERMINE THE MINIMUM COST SOLUTION. DESIGN DATA AND COSTS FOR AN 8 MGD ACTIVATED SLUDGE PLANT ARE PRESENTED FOR THE LEAST COST SOLUTION FOR EACH LEVEL OF EFFICIENCY. AT THE LOWER EFFICIENCIES, AERATION COSTS GO DOWN, BUT CLARIFICATION COSTS RISE. A LINEAR REGRESSION MODEL PREDICTING BOD REMOVAL EFFICIENCY IS PRESENTED FOR LAGOONS. ALTHOUGH THE USE OF LAGOONS IS NOT RECOMMENDED FOR CANNERY WASTES DUE TO THE LACK OF NITROGEN AND THE SHOCK LOADING A LAGOON RECEIVES WHEN THE CANNING SEASON BEGINS. CHEMICAL PRECIPITATION COMBINED WITH SEDIMENTATION ALLOWED BOD REMOVALS TO APPROACH 50%. CHEMICAL OXIDATION WITH POTASSIUM PERMANGANATE OFFERS ATTRACTIONS IN ITS SIMPLICITY OF OPERATION AND EASE OF CONTROL. ECONOMIC CONSIDERATIONS WOULD BE THE MAIN DETERMINANT IN ITS SELECTION. (W70-08303).

00339. DESIGN OF U-TUBE AERATION SYSTEMS.

SPEECE, R.E.; OROSCO, R.
JOURNAL, SANITARY ENGINEERING DIVISION, PROCEEDINGS AMERICAN SOCIETY OF CIVIL ENGINEERS, 96(SA3), 715-725, 1970.

FOUR INDEPENDENT PARAMETERS WERE STUDIED IN THE DESIGN OF U-TUBE AERATION SYSTEMS. (1) AIR-WATER RATIOS, (2) INLET DISSOLVED OXYGEN CONCENTRATION, (3) DEPTH, AND (4) WATER VELOCITY. EACH DIFFERENT COMBINATION OF PARAMETERS WILL RESULTS IN DIFFERENT CAPITAL AND OPERATING COSTS. OUTLET DISSOLVED OXYGEN CONCENTRATION IS REPORTED IN THIS STUDY FOR THE FOLLOWING RANGES OF INDEPENDENT PARAMETERS. (1) AIR-WATER RATIOS-5 TO 25%, (2) INLET DISSOLVED OXYGEN-O TO 100% SATUATION, (3) DEPTH-20 TO 40 FEET, AND (4) WATER VELOCITY-3.6 TO 9.2 FEET PER SECOND. THE COMPUTER MODEL OF THE GAS TRANSFER EQUATION ADAPTED TO U-TUBE AERATOR WAS USED TO EVALUATE THE REAERATION COEFFICIENT K2. TRANSFER OF GASES OTHER THAN OXYGEN IS ANALYZED. (W70-08326).

00340. WATER QUALITY: COSTS BENEFITS AND IRREDUCIBLES.

STONE, R.; GARBER, W.; FRIEDLAND, H.
JOURNAL, SANITARY ENGINEERING DIVISION, PROCEEDINGS AMERICAN SOCIETY OF CIVIL ENGINEERS, 96(SA3), 691-697, 1970.

THE ASCE COMMITTE ON SEWERAGE AND SEWAGE TREATMENT DESIGN DESIGNED A QUESTIONNAIRE FOR DISTRUBUTION TO SANITARY ENGINEERING DIVISION MEMBERSHIP. THE PURPOSE OF THE QUESTIONNAIRE WAS TWOFOLD: (1) TO DETERMINE THE MEMBERSHIP'S ATTITUDES AND OPINIONS CONCERNING THE EXISTING AND FUTURE SOCIAL AND ECONOMIC VALUE OF ALTERNATIVE BENEFICIAL USES OF THE NATION'S WATER RESOURCE AND A FEW GENERAL QUESTIONS RELATING RESPONSE TO IMMEDIATE OPERATIONAL EXPERIENCE, (2) TO DEMONSTRATE AN ALGORITMIC TECHNIQUE FOR QUANTIFYING NONDETERMINISTIC OR PROBABILISTIC DATA. APPROXIMATELY 350 DIVISION MEMBERS (20%) RESPONDED. THEY GAVE VALUE JUDGEMENT RATINGS (RANGE FROM 1 TO 10) FOR SOCIAL AND ECONOMIC BENEFITS. THE ANALYSIS OF QUESTIONNAIRES WAS BASED ON BOTH AN ALGORITHMIC MATHEMATICAL FORMULATION AND THE DELPHI METHOD DEVELOPED BY THE RAND CORPORATION. BOTH CONCEPTS WERE TESTED AND FOUND TO SUPPORT THREE BASIC PREMISES: (1) THE OPINIONS OF A LARGE SAMPLE OF INFORMED PERSONS HAVE SIGNIFICANT VALUE, (2) QUALITATIVE JUDGEMENTS CAN BE QUANTIFIED BY USE OF AN ABSTRACT SCALE OF RELATIVE VALUES, AND (3) AVERAGING, RANKING, AND NORMALIZING THE RESULTING DATA PROVIDES TOOLS FOR FURTHER INFORMATION ANALYSIS. THE STUDY INDICATED THAT IT IS POSSIBLE TO QUANTIFY TO A DEGREE QUALITATIVE INFORMATION, THAT SANITARY ENGINEERS ARE AWARE OF IMPORTANT SOCIAL VALUES, AND THAT ALTHOUGH EXISTING RESEARCH AND DEVELOPMENT WORK IS MAKING A SIGNIFICANT CONTRIBUTION THIS TECHNOLOGICAL LEVEL CAN BE GREATLY IMPROVED. (W70-08328).

00341. CLEAN WATER ULTIMATE DISPOSAL.

SEBASTIAN, F.; SHERWOOD, R.
WATER AND SEWAGE WORKS, 116(8), 297-300, 1969.

THE UNIQUE APPLICATION OF THERMAL SYSTEMS FOR SOLID WASTE RECLAMATION AND DISPOSAL AT THE SOUTH TAHOE PHOSPHATE REMOVAL AND WATER RECLAMATION PLANT WAS PRESENTED. THREE UNIQUE THER-

MAL PROCESSING SYSTEMS WERE EMPLOYED. BARTLET SNOW PACIFIC MULTIPLE HEARTH FURNACES WERE USED IN THE THERMAL TREATMENT SYSTEMS. THE FIRST SYSTEM PROCESSES A RELATIVELY WET DEWATERED SLUDGE, 15-20 PERCENT TOTAL SOLIDS, OBTAINED FROM THE ADDITION OF LIME TO RAW PRIMARY SLUDGE. ELIMINATION OF ALL ODORS AND STEAM PLUME WAS OBTAINED. LIME TREATMENT OF THE SEWERAGE PLANT EFFLUENT PRODUCES ANOTHER DISTRICT SLUDGE WHICH WAS CENTRIFUGED PRODUCING A CAKE OF ABOUT 50% MOISTURE. THIS SLUDGE WAS RECALCINED AT TEMPERATURES APPROACHED 1900 DEG F. FOR EVENTUAL RECOVERY OF THE LIME. DRY LIME STORAGE WAS POSSIBLE WITHOUT THE ASSOCIATED DUST PROBLEMS BY THE APPLICATION OF A THERMAL DISC COOLER. THE TDC UTILIZED WATER AS THE HEAT TRANSFER LIQUID AND DECREASED THE TEMPERATURE OF THE CALCINED LIME FROM 1400 DEG F TO LESS THAN 400 DEG F. THERE WAS VIRTUALLY NO RECARBONATION AS THE SYSTEM WAS TOTALLY ENCLOSED. THE THIRD SYSTEM WAS USED IN THE REGENRATION OF ACTIVATED CARBON AT THE COST OF $0.23 PER LB. (W70-08337).

00342. FIELD TRIALS OF ANTIMYCIN AS A SELECTIVE TOXICANT IN CHANNEL CATFISH PONDS.

BURRESS, R.M.; LUHNING, C.
INVESTIGATIONS IN FISH CONTROL, NO. 25, 1969. 11 P.

ANTIMYCIN EFFECTIVELY AND ECONOMICALLY CONTROLLED HEAVY INFESTATIONS OF GREEN SUNFISH AND GOLDEN SHINERS FROM CHANNEL CATFISH PONDS AT A MISSISSIPPI FISH FARM. AN INITIAL APPLICATION OF 5 P. P. B. OF ANTIMYCIN IN TWO PONDS AND 7.5 P. P. B. IN THE THIRD POND ELIMINATED NEARLY 99 PERCENT OF THE SCALEFISHES. A FOLLOWUP TREATMENT OF 10 P. P. B., 4 DAYS LATER, FURTHER REDUCED THESE POPULATIONS WITH NO APPARENT EFFECT ON YEARLING CATFISH. AT HARVEST, THREE UNTREATED PONDS PRODUCED 1,474 POUNDS OF SCALEFISHES OR AN AVERAGE OF 389 POUNDS PER ACRE, YIELDED 27.4 PERCENT OR 1,155 FEWER CATFISH THAN THE THREE TREATED PONDS, AND CONTAINED 1,183 UNDERSIZE FISH OR NEARLY THREE TIMES AS MANY THAT WERE TOO SMALL FOR TABLE USE. TREATED PONDS PRODUCED AN ADDITIONAL 1,015 POUNDS OF FISH WORTH $507.50, WHILE ANTIMYCIN COST ONLY $145.79. (W70-08364).

00343. USE OF ANTIMYCIN FOR SELECTIVE THINNING OF SUNFISH POPULATIONS IN PONDS.

BURRESS, R.M.; LUHNING, C.W.
INVESTIGATION IN FISH CONTROL, NO 28, 1969.

SELECTIVE REMOVAL OF BLUEGILLS, REDEAR SUNFISH, AND REDBREAST SUNFISH WAS ACCOMPLISHED IN SIX SOFT-WATER PONDS IN WEST CENTRAL GEORGIA BY APPLICATIONS OF 0.4,0.6,0.8, AND 1.0 PARTS PER BILLION (P. P. B.) OF ANTIMYCIN IN THE FINTROL-5 FORMULATION. SUCCESSFUL TREATMENTS WERE MADE DURING WINTER, SPRING, AND LATE SUMMER AT WATER TEMPERATURES RANGING FROM 46 DEG TO 75 DEG F. AND UNDER A WIDE VARIETY OF WEATHER CONDITIONS. THE 0.4-P. P. B. TREATMENT MADE AT 75 DEG F. REMOVED 2.9 POUNDS PER ACRE OF LARGEMOUTH BASS LESS THAN 6 INCHES LONG AND 69 POUNDS PER ACRE OF ALL SIZES OF SUNFISHES. THE 3.6 P. P. B. APPLIED AT 47 DEG F. REDUCED THE NUMBERS OF BLUEGILLS LESS THAN 9 INCHES IN LENGTH BY ABOUT HALF, VERY LITTLE EFFECT ON LARGEMOUTH BASS OR LARGER BLUEGILLS. BASS, BLUEGILLS, AND REDEAR SUNFISH WHICH SURVIVED MULTIPLE EXPOSURES TO ANTIMYCIN IN CONCENTRATIONS UP TO 1.0 P. P. B. WERE ABLE TO REPRODUCE NORMALLY. (W70-08367).

00344. QUINALDINE AS AN ANESTHETIC FOR BROOK TROUT, LAKE TROUT, AND ATLANTIC SALMON.

LOCKE, D.O.
INVESTIGATIONS IN FISH CONTROL, NO. 24, 1969. 4 P.

QUINALDINE (2-METHYLQUINOLINE) WAS AN EFFECTIVE ANESTHETIC FOR YEARLING ATLANTIC AND LANDLOCKED SALMON AND BROOK AND LAKE TROUT IN WATERS RANGING FROM 10 TO 40 PPM TOTAL HARDNESS AND TEMPERATURES RANGING FROM 36 DEG TO 40 DEG F. AND FROM 47 DEG TO 59 DEG F. LAKE TROUT WERE MORE SENSITIVE THAN THE OTHER SPECIES TESTED. IN TESTS, ANESTHETIZATION AND RECOVERY RATES FOR FIVE CONCENTRATIONS (5,10,15,20 AND 25 PPM) AT BOTH TEMPERATURES WAS GENERALLY SATISFACTORY FOR LAKE TROUT. A CONCENTRATION OF 15 PPM WAS SATISFACTORY FOR MARKING AND GENERAL HANDLING OF SALMON AND BROOK TROUT. QUINALDINE IS ONE TWENTY-FOURTH AS EXPENSIVE AS MS-222 AT 1: 12,000, AND IN VIEW OF THE RESULTS THE AUTHOR FEELS THIS DRUG WARRANTS WIDER USE AS A FISH ANESTHETIC. (W70-08383).

00345. WILMINGTON GOES ON LINE WITH MODERN NEW SECONDARY TREATMENT PLANT.

WATER AND SEWAGE WORKS, 116(12), 471, 473, 1969.

COMPLETION OF A $4 MILLION SECONDARY SEWAGE TREATMENT FACILITY ALLOWS WILMINGTON, DELAWARE, TO MEET FEDERAL REGULATIONS GOVERNING WATER POLLUTION. THE TREATMENT FACILITY SERVES A POPULATION OF 500,000 PERSONS WITH A COMBINED INDUSTRIAL AND DOMESTIC FLOW OF 60 MGD IN 1968. THE SECONDARY TREATMENT PLANT CONSISTS OF TWO AERATION TANKS, EACH 14,400 SQ FT, WITH A COMBINED CAPACITY OF 3,320,000 GAL AND TWO FINAL CLARIFIERS WITH A COMBINED CAPACITY OF 3,750,000 GAL. FOUR ROTARY POSITIVE BLOWERS PROVIDE A FLEXIBLE SUPPLY OF AIR TO THE AERATION TANKS. TWO BLOWERS ARE EQUIPPED WITH CONSTANT SPEED 250 HP MOTORS AND TWO WITH VARIABLE SPEED 250 HP MOTORS. THE BOD REMOVAL IS APPROXIMATELY 55% FOR BOTH PRIMARY AND SECONDARY PLANTS. (W70-08399).

00346. WET AIR OXIDATION AT LEVITTOWN.

BLATTLER, P.X.
WATER AND SEWAGE WORKS, 117(2), 32-34, 1970.

LEVITTOWN, PENNSYLVANIA HAS SOLVED ITS SLUDGE DISPOSAL PROBLEM WITH THE INSTALLATION OF A LOW PRESSURE OXIDATION UNIT WHICH PROVIDES WET OXIDATION OF ITS RAW AND DIGESTED SLUDGE. SLUDGE IS PUMPED TO THE PROCESS AT A PRESSURE OF APPROXIMATELY 300 PSI AND IS PASSED THROUGH A HEAT EXCHANGER AND HEATED TO A TEMPERATURE OF 300 DEG F BY THE OUTGOING OXIDIZED SLUDGE BEFORE ENTERING THE REACTOR. A REACTOR OUTLET TEMPERATURE OF 340-350 DEG F IS OBTAINED EITHER FROM HEAT GIVEN OFF BY THE OXIDATION OR BY STEAM INJECTED INTO THE SYSTEM. ODORS ARE COMPLETELY REMOVED BY PASSING THE GASES THROUGH A CATALYTIC COMBUSTION UNIT AT TEMPERATURES OF 650-750 DEG F. THE OXIDIZED SLUDGE IS THEN VACUUM FILTERED WITHOUT CHEMICAL ADDITIVES. TYPICAL SLUDGE CHARACTERISTICS, OPERATING PERFORMANCE AND FILTRATION DATA ARE PRESENTED IN TABULAR FORM. CAPITAL COSTS WERE APPROXIMATELY $200,000 AND OPERATING COSTS WERE ITEMIZED. AN OPERATING COST OF $11.16 PER TON OF DRY SOLIDS AT AN OPERATING RATE OF 3.65 TONS PER DAY IS REPORTED. (W70-08400).

COST ANALYSIS OF WATER POLLUTION CONTROL

00347. CANADA'S LARGEST SLUDGE INCINERATORS FIRED UP AND RUNNING.

WATER AND POLLUTION CONTROL, 107(1), 20-24, 1969.

THREE MULTI-HEARTH SEWAGE SLUDGE INCINERATORS RATED AT A COMBINED CAPACITY OF 134 DRY TONS PER DAY WERE INSTALLED AT THE MAIN TREATMENT PLANT AT ASHBRIDGES BAY IN TORONTO. THE MULTIPLE-HEARTH FURNACES ARE CYLINDRICAL, REFRACTORY-LINED STEEL SHELLS CONTAINING A SERIES OF HORIZONTAL REFRACTORY HEARTHS LOCATED ONE ABOVE THE OTHER. COMBUSTION TAKES PLACE IN AN ENCLOSED ENVIRONMENT AS THE FURNACE IS DIVIDED INTO THREE DISTINCT ZONES OF DRYING, COMBUSTION AND COOLING. COMBUSTION TEMPERATURES ARE BETWEEN 1400 AND 1600 DEG F. THE LOADING RATE IN LBS/HR OF FILTER CAKE TO EACH FURNACE CAN REACH 23,900 BASED ON A MOISTURE CONTENT OF 80%. RESIDUAL INORGANIC ASH IS PUMPED AS A SLURRY TO A NEAR-BY LAGOON. TESTS OF THE LIQUID OVERFLOW SHOW THAT IS HAS A BOD OF ONLY 2 TO 3 PPM. EACH INCINERATOR IS EQUIPPED WITH A FLUE-GAS SCRUBBER SYSTEM. THIS COMPLIES TO A CODE WHICH CALLS FOR A DISCHARGE OF NOT MORE THAN 0.30 LB OF DUST PER 1000 POUNDS OF GAS ADJUSTED TO 12% CO2. THE INCINERATORS WERE INSTALLED AT A TOTAL CONTRACT PRICE OF 3.8 MILLION DOLLARS. (W70-08402).

00348. EVALUATION PROCESSES IN WATER RESOURCES PLANNING.

AMERICAN WATER RESOURCES ASSOCIATION. REPORT OF A RESEARCH CONFERENCE AT MILWAUKEE, WISCONSIN, JUNE 16-20, 1970. 160 P.

THIS IS THE REPORT OF AN INTERDISCIPLINARY RESEARCH CONFERENCE ON EVALUATION PROCESSES IN WATER RESOURCE PLANNING. DUE TO THE INTERESTS OF THOSE PARTICIPATING, THE MAJOR EMPHASIS WAS ON THE SUBJECT OF MULTIPLE OBJECTIVE PLANNING, WHICH IS ABOUT TO BE INCORPORATED INTO FEDERAL APPROACHES BY THE WATER RESOURCES COUNCIL. ALTHOUGH THE CONSENSUS OF THOSE PRESENT CLEARLY APPROVED OF THE MAIN THRUST OF THE NEW PROPOSALS, THERE WERE MANY CONFLICTING VIEWS EXPRESSED BOTH AS TO THE BASIC SIGNIFICANCE OF THE CHANGE AND AS TO HOW IT MIGHT BE IMPLEMENTED. THE BASIC CONCEPT OF THE CONFERENCE PRECLUDED FORMAL PAPERS OR ATTRIBUTION OF INDIVIDUAL VIEWS, BUT THE PRINICPAL VIEWPOINTS ARE SUMMARIZED IN THE CONFERENCE REPORT. BESIDES MULTIPLE OBJECTIVE PLANNING, OTHER SUBJECTS OF MAJOR INTEREST INCLUDED THE ECONOMICS OF WATER QUALITY CONTROL, FLOOD PLAIN MANAGEMENT AND FLOOD INSURANCE, SPECIAL PROBLEMS OF METROPOLITAN WATER RESOURCES ANALYSIS, POLITICAL AND ECONOMIC ASPECTS, AND ENVIRONMENTAL AND AESTHETIC ASPECTS OF EVALUATION PROCESSES. (W70-09369).

00349. ECONOMICS OF CANNERY WASTE TREATMENT.

EVENSON, D.E.; ORLOB, G.T.
WATER AND SEWAGE WORKS, 117(3), 18-19, 1970.

THE USE OF A DYNAMIC PROGRAMMING ALGORITHM TO INVESTIGATE THE ECONOMICS OF CANNERY WASTE TREATMENT WAS DEMONSTRATED. THE ALGORITHM FOUND THE MINIMUM COST-SIZE-EFFICIENCY RELATIONSHIPS FOR REMOVING BOD FROM A CANNERY WASTE AND TREATING AND DISPOSING OF THE SOLID WASTES. THE ITEMS CONSIDERED WERE IN-PLANT WASTE TREATMENT, MUNICIAPL WASTE TREATMENT SYSTEMS, AND ONE FLOW OF WASTE WATER, THAT LEAVING THE CANNERY. THE IN-PLANT TREATMENT CONSISTED OF 5 COMPONENTS: SCREENING, BOD REMOVAL FROM LIQUID WASTES, ULTIMATE LIQUID DISPOSAL, SOLID WASTE TREATMENT, AND DISPOSAL. ELEVEN ALTERNATIVE UNIT PROCESSES COMPRISED CONPONENT II. VACUUM FILTRATION AND SOLIDS OXIDATION WERE THE ALTERNATIVES FOR COMPONENT IV. TWO ALTERNATIVES WERE CONSIDERED FOR SOLIDS DISPOSAL: COMPOSING AND LANDFILL. THE PREDOMINANT TREATMENT SYSTEM THAT MINIMIZED COST CONSISTED OF SCREENING, AN AERATED LAGOON, AND, DEPDENING ON THE SIZE OF THE PLANT, EITHER LANDFILL OR COMPOSING. AN EXAMPLE PROBLEM ILLUSTRATED THE USE OF THESE MINIMUM COST-SIZE-EFFICIENCY RELATIONSHIPS. A SEWER SERVICE CHARGE WAS ASSUMED IN ORDER TO EVALUATE THE ALTERNATIVES BETWEEN TREATING THE WASTES IN-PLANT, DISCHARGING TO A MUNICIPAL SYSTEM, OR COMBINATION OF THE TWO. (W70-09338).

00350. ENVIRONMENTAL QUALITY.

FIRST ANNUAL REPORT OF THE COUNCIL ON ENVIRONMENTAL QUALITY TOGETHER WITH PRESIDENT'S MESSAGE, TRANSMITTED TO CONGRESS AUGUST 1970. 326 P.

A COMPREHENSIVE AND USEFUL STATEMENT IS GIVEN OF THE PRINCIPAL ENVIRONMENTAL ISSUES THAT CONFRONT THE NATION - WATER POLLUTION, AIR POLLUTION, INADVERTENT MODIFICATION OF WEATHER AND CLIMATE, DISPOSAL OF SOLID WASTES, PROBLEMS OF LAND USE, PESTICIDES, AND RADIATION. PREPARED BY THE PRESIDENT'S COUNCIL ON ENVIRONMENTAL QUALITY AND TRANSMITTED TO THE CONGRESS AUGUST 10,1970. THE REPORT DESCRIBES THE PROBLEMS AND ISSUES WHICH NEED TO BE ATTACKED, BUT OFFERS NO OVERALL SOLUTIONS. PRESSURES ON THE ENVIRONMENT ARE DISCUSSED IN A CHAPTER ON POPULATION, ECONOMIC GROWTH, AND RESOURCES. AN IMPORTANT PROPOSAL IS MADE FOR A NATIONAL LAND USE POLICY. IN WATER POLLUTION, THE REPORT URGES AN INCREASE IN FUNDS FOR WASTE TREATMENT; A PROGRAM IN ONE RIVER BASIN TO DEMONSTRATE CONCEPTS OF WATER QUALITY MANAGEMENT; EFFECTIVE ENFORCEMENT OF WATER QUALITY STANDARDS; A STRONG FEDERAL POLICY TO CONTROL THERMAL POLLUTION; DEVELOPMENT OF A POLICY FOR OCEAN DISPOSAL OF WASTES; CREATION OF NEW METHODS TO PREVENT, CONTROL AND CLEAN UP OIL SPILLS; AND INTENSIFIED ATTACK ON AGRICULTURE POLLUTION. COSTS TO CLEAN UP THE NATION'S WATER OVER THE NEXT 10 YEARS WILL TOTAL $10 BILLION. (GPO $1.75) (W70-09347).

00351. RELATIONSHIP OF DOMESTIC WATER USE TO ASSESSED VALUATION WITH SELECTED DEMOGRAPHIC SOCIOECONOMIC VARIABLES.

DUNN, D.; LARSON, T.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 55, 441-450, 1963.

00352. PAPILLION CREEK AND TRIBUTARIES, NEBRASKA.

U S 90TH CONGR, 2D SESS, HOUSE DOC NO 049, 174 P. 1968.

A MULTIPLE-PURPOSE FLOOD CONTROL, WATER QUALITY CONTROL, AND RECREATIONAL PROJECT IS PROPOSED FOR PAPILLION CREEK, OMAHA, NEBRASKA. THE PROJECT INCLUDES 21 DAMS AND RESERVOIRS, IN 8 OF WHICH WATER-QUALITY CONTROL PROVISIONS WOULD BE IN-

CLUDED. ESTIMATED COST IS $26,800,000. HYDROELECTRIC POWER AND NAVIGATION DEVELOPMENT ARE INFEASIBLE. THE BENEFIT-COST RATIO OF THE 21 RESERVOIRS AS PROPOSED IS 2.0 TO 1. (W69-02282).

00353. DYNAMIC ECONOMIC EFFICIENCY OF WATER QUALITY STANDARDS OR CHARGES.

BROWN, G. J.; MAR, B.

WATER RESOURCES RESEARCH, 4(6), 1153-1159, 1968.

IF A MANAGER OF A GIVEN WATER RESOURCE IS UNCERTAIN OF HIS POWER TO SET OPTIMUM STREAM STANDARDS OR OPTIMUM EFFLUENT CHARGES AT EVERY MOMENT IN TIME, THERE EXIST CONDITIONS, QUALITATIVELY IDENTIFIED, UNDER WHICH IT MAY BE DYANMICALLY MORE EFFICIENT FOR HIM TO ESTABLISH PRESENT WATER QUALITY LEVELS THAT WILL BE OPTIMUM ONLY AT SOME FUTURE DATE THAN TO TRY UNSUCCESSFULLY TO ACHIEVE OPTIMUM LEVELS AT EVERY POINT IN TIME. EXCESS DEMAND FUNCTIONS AND AN AGGREGATE NONLINEAR DAMAGE FUNCTION ARE THE CONCEPTIAL UNDERPINNINGS OF THIS PAPER. (W69-02549).

00354. SOME ECONOMIC PLANNING CONSIDERATIONS OF GROUNDWATER POLLUTION FOR THE UPPER PAWCATUCK RIVER BASIN IN RHODE ISLAND.

ANTAK, A.J.

MASTERS THESIS, 1970. 119 P. OWRR PROJECT A-032-RI(1).

THIS THESIS IS CONCERNED WITH THE ECONOMICS OF SUPPLYING POTABLE WATER TO THE UPPER PAWCATUCK BASIN IN RHODE ISLAND. THE BASIC QUESTION CONSIDERED WAS WHETHR OR NOT IT IS MORE ECONOMICAL TO DEVELOP AND MAINTAIN POLLUTION - FREE THE LARGE GROUNDWATER RESERVES IN EXISTENCE THERE, OR TO NOT PROTECT THESE GROUNDWATERS, AND INSTEAD, DEVELOP A SURFACE WATER SUPPLY. GROUNDWATER DEVELOPMENT AND PROTECTION WOULD CONSIST OF A LARGE MUNICIPAL WELL DEVELOPMENT AND REGIONAL SEWERAGE FACILITIES TO PREVENT THE PRIVATE DISPOSAL OF SEWAGE. ALTERNATIVE DEVELOPMENT OF A SURFACE WATER SUPPLY WOULD REQUIRE AN IMPOUNDING RESERVOIR. IT WAS FOUND THAT NO SERIOUS GROUNDWATER POLLUTION PROBLEM PRESENTLY EXISTS, BUT THAT THE POTENTIAL FOR FUTURE PROBLEMS DOES EXIST. COST DATA WERE OBTAINED FROM VARIOUS SOURCES AND ESTIMATES OF THE DEVELOPMENTAL COSTS OF REGIONAL SEWERAGE FACILITIES, MUNICIPAL GRUNDWATER DEVELOPMENT, AND A SURFACE IMPOUNDING RESERVIOR WERE MADE. IT WAS FOUND THAT THE COMBINATION OF GROUNDWATER DEVELOPMENT, AND REGIONAL SEWERAGE WAS LESS EXPENSIVE THAN THE DEVELOPMENT OF A SURFACE WATER SUPPLY FOR SYSTEMS OF SIMILAR CAPACITY. IT IS RECOMMENDED THAT THE PLANNING OF WATER SUPPLIES AND SEWERAGE BE DONE ON A COMPREHENSIVE BASIS BY CONSIDERING THEM AS A SINGLE FUNCTION. (W71-02628).

00355. CONCENTRATION OF SEAWATER BY ELECTRODIALYSIS.

KAHO, M.; WATANABE, T.

INDUSTRIAL WATER ENGINEERING, 6(11), 30-32, 1969.

THE SEA IS THE SOLE RAW MATERIAL FOR SALT PRODUCTION IN JAPAN, AND 120,000 TONS OR 13% OF THE TOTAL ANNUAL PRODUCTION OF SALT IS NOW OBTAINED BY ELECTRODIALYSIS. THE COST OF SALT PRODUCTION CAN BE REDUCED BY INCREASING THE OPERATING CURRENT DENSITY, IMPROVING THE MEMBRANE PERMSELECTIVITY TO UNIVALENT IONS, THE UTILIZATION OF BY-PRODUCTS, AND A COMBINATION OF A DUAL PURPOSE PLANT POWER GENERATION AND DESALINATION AND SALT PRODUCTION WITH ION-EXCHANGE MEMBRANES. THE DUAL PURPOSE PLANT WILL MAKE IT POSSIBLE TO OBTAIN CONCENTRATED SEAWATER WHICH IN TURN WILL MAKE OPERATION AT HIGHER CURRENT DENSITIES THAN AT PRESENT FEASIBLE. (W70-03079).

00356. PRELIMINARY DESIGN OF WASTE TREATMENT SYSTEMS.

EVENSON, D.E.; MONSER, J.R.; ORLOB, G.T.

IND WATER ENG, 16(1), 16-21, FEB 1969.

DYNAMIC PROGRAMMING TECHNIQUES WERE UTILIZED TO FIND THE BEST WASTE TREATMENT SYSTEM FOR REMOVING A SPECIFIED AMOUNT OF BIOCHEMICAL OXYGEN DEMAND (BOD) AT THE LEAST ANNUAL EXPENDITURES FOR CONSTRUCTION MAINTENANCE AND OPERATION. THIS TECHNIQUE WAS APPLIED TO WASTES TYPICAL OF A CANNERY PROCESSING TOMATOES AND PEACHES. RESULTS OF THIS APPLICATION INDICATED THAT FOR NEARLY ALL REMOVAL LEVELS THE LEAST EXPENSIVE TREATMENT PROCESS WAS SOME SYSTEM OF PONDS. SENSITIVITY ANALYSES WERE MADE TO DETERMINE THE INFLUENCE OF SUCH PARAMETERS AS INTEREST RATE, CAPITAL RECOVERY PERIOD AND LAND COST ON BOTH THE COSTS STUDIED. MINIMUM COST WAS FOUND TO BE MOST SENSITIVE TO THE LENGTH OF THE CANNING SEASON AND LEAST SENSITIVE TO INTEREST RATE. IN-PLANT TREATMENT WAS OPTED OVER MUNICIPAL TREATMENT WHEN BOD REMOVAL REQUIREMENT WAS BELOW 85%. IT WAS CONCLUDED THAT DYANMIC TECHNIQUES OUTLINED COULD BE APPLIED TO THE PRELIMINARY DEISGN OF WASTE TREATMENT SYSTEMS. (W70-03169).

00357. PRELIMINARY SELECTION OF WASTE TREATMENT SYSTEMS.

EVENSON, D.E.; ORLOB, G.T.; MONSER, J.R.

J WATER POLLUTION CONTROL FED., 41(11), PART 1, 1845-1858, 1969.

TO DETERMINE THE PRACTICALITY OF PARTIALLY DEMINERALIZING MUNICIPAL WASTE WATER BY ELECTRODIALYSIS, A BENCH-SCALE EXPERIMENT WAS MADE, USING FILTRATION ALONE AND FILTRATION FOLLOWED BY CARBON ADSORPTION AS PRETREATMENTS. LONG-TERM RUNS WERE MADE WITH A MUNICIPAL SECONDARY EFFLUENT TO DETERMINE SCALING AND FOULING EFFECTS OF THE WATER UPON THE ELECTRODIALYSIS MEMBRANES. A STUDY WAS MADE DURING THESE RUNS TO DETERMINE HOW HIGH A RATIO OF PRODUCT RATE TO CONCENTRATE RATE COULD BE OBTAINED WITHOUT FORMING SCALE ON THE MEMBRANES. SOME FOULING OF ANION MEMBRANES OCCURRED WITH FILTRATION AND CARBON ADSORPTION PRETREATMENT; WITHOUT CARBON ADSORPTION, FOULING WAS MUCH WORSE. SCALE FORMATION WAS NOT A PROBLEM AT PRODUCT TO CONCENTRATE RATIOS LESS THAN TEN. AT TIMES MUCH HIGHER RATIOS WERE OBTAINED WITHOUT DIFFICULTY. THE RESULTS OF THESE RUNS INDICATED THAT THE TOTAL OPERATING COST FOR A 10-MGD ELECTRODIALYSIS TREATMENT PLANT MIGHT BE LESS THAN $. 10 PER 1,000 GAL. (W71-03503).

00358. ELECTROCHEMICAL TREATMENT OF MUNICIPAL WASTE WATER.

MILLER, H.C.; KNIPE, W.

ENVIRONMENTAL HEALTH SERIES AWTR-13, ADVANCED WASTE TREATMENT RESEARCH PROGRAM, PUBLIC HEALTH SERVICE, ROBERT A TAFT SANITARY ENGINEERING CENTER, MARCH 1965. 58 P.

THE EFFECTIVENESS OF ELECTROLYTIC METHODS OF TREATING WASTE WATER IS IN DOUBT. THIS STUDY SHOWS THAT AN ELECTROLYTIC TREATMENT OF SECONDARY EFFLUENT FROM AN ACTIVATED-SLUDGE PLANT USING LEAD DIOXIDE ANODES CAN REDUCE ABS BY 90%, COD BY 80%, AND CHLORIDE BY 90%. THIS TREATMENT HAS LITTLE EFFECT ON TOTAL SOLIDS. THE COST OF TREATMENT WILL VARY BETWEEN $0.90 AND $2.42 PER 1,000 GALLONS. THE PLANT COST WILL VARY BETWEEN $9 MILLION AND $26 MILLION FOR A 10 MGD PLANT. THE METHOD IS NOT CONSIDERED ECONOMICALLY PRACTICAL FOR WASTE WATER RENOVATION, WHEREIN WATERS OF RELATIVELY LOW CONDUCTIVITY MUST BE PROCESSED. THE AUTHORS ALSO CONCLUDE THAT THE WORK BY THE LEAD INDUSTRIES ASSOCIATION ON THE USE OF LEAD AND LEAD-SILVER ALLOYS IN THE TREATMENT OF WASTE WATERS SHOULD BE FOLLOWED SINCE THE RESULTS MAY HAVE APPLICATIONS IN TREATING WASTE WATERS OF RELATIVELY HIGH CONDUCTIVITY. (PB-168 794) (W71-03504).

00359. ULTIMATE DISPOSAL OF ADVANCED-TREATMENT WASTE, PART 1. INJECTION, PART 2. PLACEMENT IN UNDERGROUND CAVITIES.

KOENIG, L.

ENVIRONMENTAL HEALTH SERIES AWTR-8 ADVANCE WASTE TREATMENT RESEARCH PROGRAM, US PUBLIC HEALTH SERVICE, ROBERT A TAFT SANITARY ENGINEERING CENTER, MAY 1964. 146 P.

COST ESTIMATES ARE MADE FOR ULTIMATE DISPOSAL BY INJECTION TO UNDERGROUND FORMATION, PLACEMENT IN UNDERGROUND CAVITIES AND SPREADING, OF THE CONTAMINANTS RESULTING FROM COMPLETE RENOVATION OF A MUNICIPAL WASTE WATER. FOR INJECTION, THE PROCESS PARAMETERS WERE CONCENTRATION OF CONTAMINANTS AND DAILY VOLUME TAKEN RESPECTIVELY AS 300,000, 9,000 AND 300 PPM TOTAL ORGANIC AND INORGANIC CONTAMINANTS, AND 1,000 100,000 AND 10 MILLION GPD. THESE COSTS VARY FROM $0.13 TO $27 PER 1,000 GALLONS INJECTED (7,000 FT., 260 PSI WELLHEAD PRESSURE, 1.187 FLUID DENSITY) ASTHE CAPABILITY DECREASED FROM 2 MILLION TO 1,000 GPD. COST IS RELATIVELY INDEPENDENT OF CONCENTRATION AND IS VERY MUCH CHEAPER THAN WET OXIDATION. FOR INJECTION INTO CAVITIES MINED BY CONVENTIONAL METHODS, FIXED COSTS ALONE VARY FROM $243 TO $72 PER 1,000 GALLONS AT CAPABILITIES OF 1,000 AND 10 MILLION PGD, RESPECTIVELY. SPREADING IS BY FAR THE CHEAPEST METHOD. COSTS VARY FROM $0.30 TO $0.001 PER 1,000 GALLONS AS THE CAPABILITY VARIES FROM 1,000 (0.4-FOOT-PER-DAY INFILTRATION RATE) TO 10 MILLION GPD (4.0-FEET-PER-DAY INFILTRATION RATE). LAND COSTS HAD VERY LITTLE EFFECT ON OVER-ALL COST. COSTS ARE 1 PERCENT OR LESS OF OTHER METHODS INVESTIGATED, BUT SPREADING IS SEVERLY LIMITED BECAUSE OF POTENTIAL GROUNDWATER POLLUTION. (PB-168 796) (W71-03513).

00360. ULTIMATE DISPOSAL OF ADVANCED-TREATMENT WASTE, PART 1. WET OXIDATION, PART 2. INCINERATION.

KOENIG, L.

ENVIRONMENTAL HEALTH SERIES AWTR-3, ADVANCED WASTE TREATMENT RESEARCH PROGRAM, PUBLIC HEALTH SERVICE, ROBERT A TAFT SANITARY ENGINEERING CENTER, OCTOBER 1963.78 P.

COST ESTIMATES ARE MADE FOR ULTIMATE DISPOSAL, BY WET OXIDATION (ZIMMERMAN PROCESS) AND INCINERATION, OF THE CONCENTRATED CONTAMINANTS RESULTING FROM COMPLETE REMOVATION OF A MUNICIPAL WASTE WATER. FOR WET OXIDATION, NINE HYPOTHETICAL CASES COVERED THE FLOW RANGES FROM 1,000 TO 10 MILLION PGD AND ORGANIC CONTAMINANT CONCENTRATION RANGES FROM 100 TO 100,000 PPM. PLANT COSTS VARY FROM $4 TO $80 PER GALLON OF CONCENTRATE PER DAY CAPACITY (10,000,000 TO 1,000 GALLONS PER DAY). OPERATING COSTS VARY FROM $1.40 TO $35 PER THOUSAND GALLONS OF FEED. PRE-EVAPORATION COULD REDUCE COSTS. FIXED COSTS CONSTITUTE A LARGE PROPORTION OF TOTAL COSTS. A THEORY OF THE REACTION MECHANISM IS PROPOSED FOR INCINERATION. CONSIDERATION WAS GIVEN TO THE ATOMIZED SUSPENSION TECHNIQUE, A BOX FURNACE FLASH DRYER-NICHOLS HERRESHOFF FURNACE COMBINATION, AND THREE PROCESSES UNDER DEVELOPMENT FOR CALCINATION OF NUCLEAR WASTES. ESTIMATES OF PRE-EVAPORATION TO 30% SOLIDS AND HAULING OF ASH WERE INCLUDED. A FLASH DRYER-NICHOLS HERRESHOFF FURNACE COMBINATION WAS SELECTED. COSTS PER 1,000 GALLONS OF CONCENTRATE VARIED FROM $0.57 (10,000,000 GALLONS PER DAY, 300 PPM). CORRESPONDING UNIT INVESTMENT COSTS WERE $1.53 AND $10 PER GALLON PER DAY CAPACITY. (PB-168 977) (W71-03514).

00361. ECONOMIC ASPECTS OF SEWAGE WORKS DESIGN.

CUPIT, J.V.

WATER POLLUTION CONTROL, 68(2), 166-177, 1969.

THE BASIC COST FACTORS ASSOCIATED WITH THE DESIGN OF A SEWAGE WORKS ARE DISCUSSED, AND THE APPLICATION OF THESE COST FACTORS TO THE DESIGN OF INDIVIDUAL UNITS IS CONSIDERED. THE CONCEPT OF TRUE COST IS DEFINED AS THE ANNUAL CHARGE RELATIVE TO A PARTICULAR UNIT, AND THE MAJOR COMPONENTS OF THE ANNUAL COST ARE DISCUSSED. THESE INCLUDE: LOAN DEBT CHARGES; RENTS AND RATES; EMPLOYMENT OF LABOR; PURCHASE OF FUEL AND POWER; REPAIR AND MAINTENACE OF PLANT, BUILDINGS, AND MACHINERY; PLANT AND MACHINERY INSURANCE; MATERIAL PURCHASES; AND TRANSPORTATION. CONSIDERATION OF THE APPLICATION OF THE COST FACTORS INCLUDES DISCUSSIONS OF THE PUMPING PLANT, PRELIMINARY TREATMENT UNITS, BIOLOGICAL TREATMENT, TERTIARY TREATMENT, AND SLUDGE TREATMENT AND DISPOSAL. PARTICULAR EMPHASIS IS PLACED ON THE TOPICS OF SEDIMENTATIONS, AND ENGINEERING PRINCIPLES SHOULD BE COMBINED WITH THE ENGINEER'S PERSONAL JUDGEMENT IN ORDER TO ACHIEVE A BALANCED SOLUTION OF THE DESIGN CONCEPT. (W70-05809).

REFERENCE LIST

00362. AN ECONOMIC APPROACH TO REGIONAL INDUSTRIAL WASTE MANAGEMENT.

DYSART, B.C. III.,
PAPER PRESENTED AT 24TH PURDUE IND WASTE CONF, PURDUE UNIV. MAY 6-8 1969. 24 P.

AN ECONOMIC APPROACH TO REGIONAL INDUSTRIAL WASTE MANAGEMENT WAS PRESENTED. TWO PROBLEM LEVELS WERE CONSIDERED; A RESOURCE ALLOCATION PROBLEM FOR WHICH WASTE ASSIMILATIVE CAPACITY WAS ALLOCATED TO AMONG COMPETING USERS AND THE OBJECTIVE WAS ECONOMIC EFFICIENCY WITH DISSOLVED OXYGEN STANDARDS (DO) AS CONSTRAINTS. THE SECOND PROBLEM LEVEL CONSISTED OF INVESTIGATING THE RESPONSE ON SENSITIVITY OF THE MINIMUM TOTAL SYSTEM COST AND THE OPTIMAL MANAGEMENT POLICY TO SYSTEM VARIATION. A HYPOTHETICAL RIVER BASIN SYSTEM CONSISTING OF THREE STREAM REACHES OR STAGES IN SERIES WITH AN INDUSTRIAL WASTE OUTFALL LOCATED AT THE UPSTREAM END OF EACH STAGE WAS USED TO ILLUSTRATE THE TWO PROBLEM LEVELS. A DYNAMIC PROGRAMMING RECHNIQUE WAS FOUND TO BE USEFUL IN DETERMINING THE MINIMUM-COST MANAGEMENT SYSTEMS THAT MET ALL CONSTRAINTS FOR A FIXED SYSTEM CONFIGURATION. (W70-03619).

00363. SLUDGE DISPOSAL ALTERNATIVES--SOCIO-ECONOMIC CONSIDERATIONS.

MAR, B.W.
J WATER POLLUTION CONTROL FED., 41(4), 547-552, 1969.

THE NECESSITY FOR SOCIO-ECONOMIC CONSIDERATIONS IN RELATION TO SLUDGE DISPOSAL ARE DISCUSSED. RESULTS OF ANALYSES INDICATE THAT SLUDGE DISPOSAL IS NOT A MAJOR SYSTEM CONSIDERATION IN A WASTE WATER MANAGEMENT SYSTEM UNLESS ONLY PRIMARY TREATMENT IS USED. THE AMOUNT OF TREATMENT FOR SLUDGE PRIOR TO DISCHARGE SHOULD BE DECIDED ON A SOCIO-ECONOMIC BASIS RATHER THAN TECHNICAL CONSIDERATIONS. THE DECISION IS MADE THROUGH A MUDDLING PROCESS RATHER THAN THROUGH A LOGICAL BASIS, AND MOST ECONMIC ARGUMENTS DO NOT CONSIDER SHIFTS IN SOCIAL PREFFRENCES NOR TOTAL SOCIAL COSTS. THE COSTS OF DISCHARGING THE RESIDUE TO THE LESS SENSITIVE ELEMENT OF THE ENVIRONMENT WILL BE SMALL COMPARED TO THE TOTAL COST OF MAINTAINING THE ENVIRONMENT. RESOURCES NORMALLY DEVOTED TO REDUCING THE COST OF SLUDGE DISPOSAL SHOULD BE DIRECTED TOWARD REDUCING THE COST OF MAJOR ELEMENTS OF ENVIRONMENTAL POLLUTION. THE ALTERNATIVE TO THIS WOULD BE TO COLLECT THE EQUIVALENT OF THE DISCHARGE TREATMENT COSTS FOR THE PERIOD PRIOR TO ENVIRONMENTAL DAMAGE AND THEN USE THESE FUNDS TO COMPENSATE THOSE PARTIES SUFFERING DAMAGE AND TO PROVIDE TREATMENT NECESSARY TO REDUCE DAMAGES TO A SOCIALLY ACCEPTABLE LEVEL. IN EITHER SITUATION, IT IS THE SOCIO-ECONOMIC FORCES THAT WILL ESTABLISH THE CRITERIA FOR SLUDGE DISPOSAL. (W70-06862).

00364. NEUTRALIZATION OF HIGH FERRIC IRON ACID MINE DRAINAGE.

WILMOTH, R.C., SCOTT, R.B.
PAPER PRESENTED BEFORE THIRD SYMPOSIUM ON COAL MINE DRAINAGE RESEARCH, MELLON INSTITUTE, PITTSBURGH, PENN, 1970.

THE NORTON MINE DRAINAGE FIELD SITE OF THE FEDERAL WATER QUALITY ADMINISTRATION HAS BEEN CONDUCTING RESEARCH ON THE FEASIBILITY OF ACID MINE DRAINAGE TREATMENT USING LIME, LIMESTONE, AND SODA ASH NEUTRALIZATION. THE NORTON RESEARCH FACILITY IS LOCATED AT NORTON, WEST VIRGINIA, ON THE BANKS OF GRASSY RUN--A SMALL, HEAVILY POLLUTED STREAM OF WHICH AN ESTIMATED 90% OF THE WATER FLOW IS FROM ABANDONED MINES. TESTS WERE RUN ON IDENTICAL SAMPLES OF GRASSY RUN WATER TO DETERMINE THE QUALITY OF THE SUPERNATANT WHEN THE SAMPLE WAS NEUTRALIZED TO VARIOUS PH'S. LIME, LIMESTONE, AND SODA ASH WERE EACH TESTED AS THE NEUTRALIZING AGENTS. ALL 3 NEUTRALIZING AGENTS--LIME, LIMESTONE, AND SODA ASH--CAN MEET THE PH 6.5, NET ALKALINITY, IRON BELOW 7.0 PPM CRITERIA WITH RELATIVE EASE. THE MAJOR DIFFERENCES BETWEEN SODA ASH NEUTRALIZATION AND LIME OR LIMESTONE NEUTRALIZATION ARE THAT SODA ASH PRODUCES LOW HARDNESS, LOW CALCIUM, HIGH SODIUM, AND HIGH COST, WHERAS ALL OTHER CHEMICALPARAMETERS ARE COMPARABLE BETWEEN THE 3 NEUTRALIZING AGENTS. (PB-192 087) (W70-07149).

00365. ECONOMICS OF AERATION IN WASTE TREATMENT.

KALINSKE, A.A.
PROCEEDINGS INDUSTRIAL WASTE CONFERENCE, 23RD, MAY 1968. P 388-397.

THE ECONOMICS ARE DISCUSSED OF AERATION FOR THOSE AEROBIC PROCESSES WHERE THE ORGANISMS ARE KEPT IN SUSPENSION IN THE LIQUID WASTE; PRIMARILY THE ACTIVATED SLUDGE PROCESS AND ALL ITS MODIFICATIONS, AND SO-CALLED AERATED LAGOONS. THREE PRINICPAL OXYGENATION METHODS PRESENTLY IN USE ARE: DIFFUSION OF COMPRESSED AIR, DIFFUSED AIR WITH SYBMERGED TURBINE DISPERSERS, AND MECHANICAL SURFACE ENTRAINMENT AERATORS. DIFFUSED AIR SYSTEMS WILL AVERAGE ABOUT DOUBLE THE POWER CONSUMPTION OF WELL DESIGNED MECHANICAL-TYPE SURFACE ENTRAINMENT AERATORS. INSTALLATION COSTS ALSO FAVOR THE MECHANICAL SURFACE-TYPE AERATION SYSTEMS. HIGH STRENGTH WASTES CAN BEST BE TREATED WITH ACTIVATED SLUDGE HAVING THE O2 SUPPLIED BY MECHANICAL MEANS. USE OF SURFACE AERATORS IN LARGE LAGOONS CAN BE THE CHEAPEST METHOD FOR TREATMENT OF A WIDE VARIETY OF INDUSTRIAL WASTES. THE NON-STEADY, CLEAN WATER TEST TECHNIQUE IS THE MOST USEFUL AND PRACTICAL FOR EVALUATING THE O2 INPUT EFFICIENCY OF AERATION EQUIPMENT. THE MAIN FACTOR THAT MUST BE GIVEN CAREFUL ATTENTION IS THAT THE BASIC CONTENTS ARE PROPERLY MIXED BY THE AERATOR. (W70-08307).

00366. CONTACT STABILIZATION PROCESS CHOSEN FOR NEW DRYDEN PLANT.

WATER AND POLLUTION CONTROL, 107(4), 32-33, 1969.

THE CONTACT STABILIZATION PROCESS WAS CHOSEN FOR THE DRYDEN ONTARIO, WASTEWATER TREATMENT PLANT BECAUSE THE WASTE WAS PREDOMINANTLY DOMESTIC SEWAGE. THE PLANT WAS DESIGNED FOR A DAILY CAPACITY OF 1 MGD AND A MAXIMUM CAPACITY OF 2.5 MGD WITH A 90% REMOVAL RATE. THE PLANT CONSISTS OF A 30-FT PUMP STATION, A 10-FOOT DIAMETER DORR-OLIVER-LONG DETRITOR UNIT, AND 18-INCH CHICAGO PUMP MODEL C BARMINUTOR, TWO 500,000 GPD SMITH AND LOVLESS OXIGEST BIOLOGICAL TREATMENT UNITS, AND A 12-FOOT BY 30-FOOT CHLORINE CONTACT CHAMBER. THE CONTACT STABILIZATION PROCESS HAS THE TWO-FOLD ADVANTAGE OF REDUCING THE SIZE OF THE BIOLOGICAL TREATMENT UNITS, AND REDUCING THE COST OF THE INSTALLATION. THE USE OF STEEL TANKS FOR THE BIOLOGICAL TREATMENT UNITS REFLECTED THE HIGH COST OF CONCRETE WORK IN NORTHERN ONTARIO

THE TOTAL COST OF THE PROJECT WAS $1.3 MILLION, WITH THE TRUNK COLLECTOR SEWERS COSTING $675,000, THE PUMPING STATION $85,000 AND THE TREATMENT PLANT $553,000. (W70-08404).

00367. NEW PLANT CONTROLS POLLUTION AT WELLAND.

WATER AND SEWAGE WORKS, 116(11), 434-435, 1969.

DOMESTIC AND INDUSTRIAL WASTES WHICH ONCE POLLUTED THE WELLAND RIVER IN ONTARIO ARE NOW BEING TREATED AT WELLAND'S NEW PRIMARY TREATMENT PLANT. THE PLANT HAS AN AVERAGE CAPACITY OF 8 MGD WITH A PEAK DESIGN FLOW OF 20 MGD. DESIGN CRITERIA PROVIDE FOR REMOVAL OF 95% OF GRIT, 73% OF SETTLEABLE SOLIDS AND 30% OF THE BOD. THE EFFLUENT IS DISINFECTED WITH CHLORINE AND DISCHARGED TO THE RIVER, WHILE THE SLUDGE IS DIGESTED, THICKENED AND VACUUM FILTERED. THE PLANT WAS DESIGNED FOR FUTURE EXPANSION TO SECONDARY TREATMENT AND A DESIGN POPULATION OF 80,000. THE PLANT FEATURES A 75 FT. LIFT STATION, A 40 IN. BARMINUTOR, A 26 FT SQUARE DETRITOR, PRE-AERATION TANKS WITH A TOTAL CAPACITY OF 190,000 GAL FOR A DETENTION PERIOD OF 34 MIN; FOUR PRIMARY SETTLING TANKS WHICH PROVIDE A DETENTION TIME OF TWO HOURS; PRIMARY AND SECONDARY DIGESTERS, A VACUUM FILTER AND CHLORINATION EQUIPMENT. THE TREATMENT FACILITY COST $2.35 MILLION AND A CONNECTING TRUNK SEWER SYSTEM COST AN ADDITIONAL $5.5 MILLION. (W70-08415).

00368. FILTRATION AND MICROSTRAINING OF SECONDARY EFFLUENT.

BACON, V.W.; LYNAM, B.T.

A PAPER PRESENTED AT THE UNIVERSITY OF TEXAS CONFERENCE ON ADVANCES IN WATER QUALITY IMPROVEMENT, APRIL 1, 1969. 41 P.

THIS PAPER PRESENTS COMPARISONS OF EFFICIENCIES AND COSTS OF REMOVING SUSPENDED SOLIDS, AND ASSOCIATED BOD, FROM THE ACTIVATED SLUDGE EFFLUENT OF THE HANOVER SEWAGE TREATMENT PLANT USING BOTH CONTINUOUS RAPID-SAND FILTRATION AND MICROSTRAINING. THIS IS THE FIRST PERMANENT INSTALLATION OF A MICROSTRAINER IN A TERTIARY WASTEWATER TREATMENT PLANT IN THE UNITED STATES. THE SAND FILTERS ARE OF THE HARDING TYPE. THE MICROSTRAINER IS A DRUM 10 FEET IN DIAMETER BY 10 FEET LONG COVERED WITH A STAINLESS STEEL MICROFABRIC HAVING 160,000 OPENINGS PER SQUARE INCH. THE DRUM SPEED AND BACKWASH PRESSURE ARE AUTOMATICALLY CONTROLLED BY THE HEAD LOSS ACROSS THE DRUM. IT WAS FOUND THAT A RATIONAL APPROACH FOR THE ANALYSIS OF DATA, RELATIVE TO THE PERFORMANCE OF FILTRATION DEVICES IN TREATING SECONDARY, ACTIVATED SLUDGE EFFLUENTS FOR REMOVAL OF SUSPENDED SOLIDS, WOULD BE TO CONSIDER REMOVAL AS A FUNCTION OF SUSPENDED SOLIDS LOADING IN TERMS OF POUNDS PER SQUARE FOOT PER DAY. THIS TAKES INTO ACCOUNT THE PARAMETER OF HYDRAULIC LOADING IN TERMS OF GPM PER SQUARE FOOT, SOLIDS INPUT, AND THE RESULTANT INPUT FROM THE FILTRATION PROCESS. THE COSTS OF SAND FILTRATION AND MICROSTRAINING APPEAR COMPARABLE. (W70-08430).

00369. INVESTIGATION OF THE FEASIBILITY OF PURIFYING MUNICIPAL WASTE WATER BY DISTILLATION.

SPIEWAK, I.

OAK RIDGE NATIONAL LABORATORY, TENN., ORNL-TM-2547, 1969.

THE REPORT FOCUSES UPON THE TECHNICAL AND ECONOMIC FEASIBILITY OF APPLYING THE DISTILLATION PROCESS FOR DEMINERALIZATION OF MUNICIPAL WASTE WATERS. PRINCIPAL APPLICATIONS OF THE METHOD WOULD BE FOR IMPROVING THE QUALITY OF EFFLUENTS RELEASED FROM THE TREATMENT PLANTS TO RECEIVING STREAMS, AND TO SUPPLEMENT WATER SUPPLY REQUIREMENTS IN URBAN COMMUNITIES. THIS INVESTIGATION IS ONE OF A SERIES SPONSORED BY HUD TO DETERMINE THE FEASIBILITY OF NUCLEAR POWER PLANTS FOR THE PROVISION OF LOW COST THERMAL ENERGY TO URBAN AREAS. DISTILLATION HAS TWO POTENTIAL ROLES IN MUNICIPAL WASTE TREATMENT, ONE AS A MEANS OF PURIFYING WASTE WATER FOR REUSE AND SECOND AS A STEP IN THE ULTIMATE DISPOSAL OF SOLIDS. THE TECHNICAL PROBLEMS OF WASTE WATER DISTILLATION, DESCRIBED IN THE LITERATURE, ARE SUMMARIZED. COST ESTIMATES ARE GIVEN FOR A NUMBER OF POSSIBLE SYSTEMS USING DISTILLATION TO TREAT EFFLUENT FROM A CITY OF 1 MILLION POPULATION. THE ANALYSIS INDICATES THAT, ALTHOUGH ADVANCED WASTE TREATMENTS MAY INCREASE THE COST OF SEWAGE PROCESSING BY FACTORS OF UP TO FOUR TIMES, THE OVERALL COST OF WATER SUPPLY AND TREATMENT NEED NOT BE INCREASED OVER ABOUT 50%. DISTILLATION APPEARS TO BE A PROMISING METHOD OF WASTE TREATMENT, ALTHOUGH METHODS OF CONTROLLING TUBE FOULING AND DISTILLATE QUALITY REMAIN TO BE DEVELOPED. ELECTRODIALYSIS, REVERSE OSMOSIS, FREEZING AND ION-EXCHANGE ARE ALSO DISCUSSED. (W70-08431).

00370. FEASIBILITY OF ALTERNATIVE MEANS OF COOLING FOR THERMAL POWER PLANTS NEAR LAKE MICHIGAN.

DEPARTMENT OF THE INTERIOR, FEDERAL WATER QUALITY ADMINISTRATION, AUG 1970. 112 P.

THE FEASIBILITY WAS EVALUATED OF DISSIPATING WASTE HEAT FROM THERMAL POWER PLANTS LOCATED NEAR LAKE MICHIGAN. CONSIDERATION WAS GIVEN TO THE FOLLOWING METHODS: EVAPORATIVE TOWERS WITH EITHER MECHANICAL OR NATURAL DRAFT, COOLING PONDS, SPRAY COOLING CANALS, AND DRY COOLING TOWERS WITH EITHER NATURAL OR MECHANICAL DRAFT. THE STUDY AREA, LAKE MICHIGAN, WAS SUBDIVIDED INTO FOUR SECTIONS TO COMPENSATE FOR THE EFFECT OF CLIMATIC CONDITIONS. THE ANALYSIS OF METEOROLOGICAL, ECONOMIC, ENGINEERING, AND ENVIRONMENTAL ASPECTS INDICATED THAT ANY OF THE INVESTIGATED COOLING SYSTEMS ARE FEASIBLE ALTERNATIVES FOR POWER PLANTS ON LAKE MICHIGAN. THE MAXIMUM ECONOMIC PENALTY OF 9-10% WAS FOR DRY TOWERS, WHEREAS THE MINIMUM OF ABOUT 1% --FOR COOLING PONDS AND SPRAY CANALS. (W71-08680).

00371. PROBABILITY THEORY AS AN AID TO RESEARCH PLANNING.

BERTHOUEX, P.M.

JOURNAL AMERICAN WATER WORKS ASSOCIATION, 61(2), 652-658, 1970.

THE THEORY OF PROBABILITY HAS BEEN USED TO EVALUATE THE PROBLEM OF IRON REMOVAL BY OXIDATION AND RAPID SAND FILTRATION. THE EFFICIENCY AND COST OF DIFFERENT TREATMENTS ARE ESTIMATED ON THE

BASIS OF SIMPLE PROBABILITY EQUATIONS FOR INDEPENDENT, MUTUALLY EXCLUSIVE, AND NOT MUTUALLY EXCLUSIVE EVENTS OR COMPONENTS. A NETWORK DIAGRAM AND TABLES PROVIDE ILLUSTRATIONS OF THE PROBABILITY ANALYSIS FOR ALL POSSIBLE OUTCOMES BECAUSE THE PROBABILITIES ARE ASSIGNED SUBJECTIVELY. THE SUGGESTED APPROACH REQUIRES A PARTNERSHIP BETWEEN THE THEORY AND PERSONAL JUDGMENT. (W71-08682).

00372. BUILDING RELIABILITY OF PLANT, PEOPLE, AND SERVICE.

REMUS, G.

JOURNAL AMERICAN WATER WORKS ASSOCIATION, VOL 62, P 38-40, 1970.

RELIABLE OPERATION OF A WIDE-AREA SYSTEM DOES NOT HAPPEN BY CHANCE. ALTHOUGH ALL PROBLEMS CANNOT BE FORESEEN, CERTAIN OPERATIONAL, PERSONNEL, AND FISCAL POLICIES CAN BE ADOPTED TO ENHANCE THE RELIABILITY FACTOR. THIS ARTICLE DISCUSSED SOME OF MANY MAJOR DIFFICULTIES FORESEEN IN WATER SYSTEM DEVELOPMENT. TABULATED DATA INCLUDED WATER REVENUE DOLLAR DISTRIBUTION, CAPACITY AND COST OF DETROIT'S WATER TREATMENT PLANTS, AND GROWTH OF DETROIT SYSTEM ASSETS AND INDEBTEDNESS. TOTAL RELIABILITY - OF OUR PEOPLE, OUR SYSTEMS, AND OUR PUBLIC ACCEPTANCE - CAN BE ACCOMPLISHED FOR INDVIDUAL SYSTEMS AND FOR THE INDUSTRY IF WE DEVELOP THE PEOPLE TO DO THE JOB PROPERLY, WITH THE HIGHEST PROFESSIONAL CONDUCT, IF WE DEVELOP OUR SYSTEMS WITH EMPHASIS ON ALL ENGINEERING ASPECTS, RATHER THAN ON SUPPLY ALONE, IF WE ABANDON PROVINCIALISM; AND IF WE MOVE WITH, RATHER THAN REACT AGAINST, CHANGING SOCIAL AND TECHNICAL CHANGES, THEN OUR LEADERSHIP WILL BE APPARENT AND PUBLIC ACCEPTANCE WILL BE WHOLEHEARTED. (W71-08816).

00373. RISK EVALUATION IN SEWAGE TREATMENT PLANT DESIGN.

LOUCKS, D.P.

JOURNAL OF THE SANITARY ENGINEERING DIVISION, PROCEEDINGS OF ASCE, 93(SA1) 25-39, 1967.

THIS ANALYSIS WAS AN APPLICATION OF SOME PROBABILITY THEORY AND COMPUTER PROGRAMMING TO DETERMINE THE DESIGN AND OPERATING CRITERIA OF A MINIMUM-COST WASTE TREATMENT FACILITY THAT MEETS A PROBABILISTIC OR DETERMINISTIC STREAM QUALITY STANDARD. A PROBABILISTIC MODEL WAS DEVELOPED AND SOLVED TO DETERMINE THE CUMULATIVE PROBABILITY DISTRIBUTIONS OF MINIMUM DO CONCENTRATIONS FOR VARIOUS CONSECUTIVE-DAY PERIODS DOWNSTREAM FROM ANY PARTICULAR WASTE WATER TREATMENT PLANT. THE PROBABILISTIC MODEL WAS DISCUSSED. AN OUTLINE OF THE COMPUTER FLOW DIAGRAM USED FOR THE SOLUTION OF THE MODEL WAS PRESENTED. AN EXAMPLE WAS SHOWN AND THE RESULTS OF THIS EXAMPLE WERE DISCUSSED. IF AN EFFICIENCY WAS SPECIFIED FOR A PARTICULAR PLANT, WHETHER OPTIMALLY OR NOT, THE MODEL COULD BE USED TO PREDICT THE RISKS OF STANDARD VIOLATION AND TO DETERMINE THE EFFECTIVENESS OF EFFLUENT STORAGE IN REDUCING THIS RISK AS WELL AS THE COST OF WASTE WATER TREATMENT. (W71-08819).

00374. THE APPLICATION OF MEMBRANES TO SEWAGE AND WASTE TREATMENT.

OKEY, R.W.

WATER QUALITY IMPROVEMENT BY PHYSICAL AND CHEMICAL PROCESSES, UNIVERSITY OF TEXAS PRESS, AUSTIN, 1970. P 327-338.

MEMBRANE FILTRATION INCLUDES A BROAD RANGE OF SEPARATION PROCESSES SUCH AS FILTRATION, ULTRA-FILTRATION, HYPER-FILTRATION, MICROPORE-FILTRATION DIFFUSION, AND REVERSE OSMOSIS. GENERALLY, THOSE PROCESSES DEFINED AS SUPER-FILTRATION, HYPER-FILTRATION, AND MICRO-FILTRATION OR THE LIKE REFER TO PROCESSES IN WHICH DISCRETE HOLES OR PORES EXIST IN A FILTER MEDIA AND THE EFFICIENCY OF THIS TYPE OF FILTRATION DEPENDS ENTIRELY ON THE DIFFERENCE OF SIZE BETWEEN THE PORES AND THE PARTICLES TO BE REMOVED. THE PORES ARE GENERALLY IN THE ORDER OF 1000 TO 100000 A. AND LARGER. WASTE WATERS REQUIRING TREATMENT FREQUENTLY HAVE A BROAD RANGE OF CONTAMINANT SIZE VARYING FROM IONS TO COLLOIDAL PARTICLES OF UP TO 1000 TO 10000 A IN THEIR MAXIMUM DIMENSIONS. THEREFORE, MEMBRANES EMPLOYING BOTH DIFFUSIVE AND PORE FLOW HAVE APPLICATION IN WASTE MANAGMENT. MOST MEMBRANE SYSTEMS ARE DESIGNED IN A SERIES-PARALLELED LAYOUT IN WHICH THE DILUTE PROCESS STREAM PASSES THROUGH SEVERALPARALLEL MEMBRANE BLOCKS OR HOUSINGS. THIS CONCEPT DERIVES FROM THE FACT THAT DIRECT ONFLOW SYSTEMS TEND TO FOUL BADLY. OPERATING CHARACTERISTICS ARE TABULATED FOR AN ACTIVATED SLUDGE MEMBRANE PLANT TREATING BOTH RAW SEWAGE AND SECONDARY EFFLUENT. EXTENSIVE STUDIES ON THE TREATMENT OF VARIOUS PULPING WASTE STREAMS ARE DISCUSSED. IN ANOTHER EXTENSIVE STUDY OF THE REMOVAL OF IONS AND ORGANICS (2000 MW) FROM SECONDARY EFFLUENTS THE SEPARATION REQUIRED A FLUX VALUE OF 5 TO 15 GPFD AND AN OVER PRESSURE OF 100-500 PSI. TOTAL COST IS ESTIMATED AT $0.40/1000 GAL FOR A 1 MGD FACILITY AND $0.30/1000 GAL FOR A 10 MGD FACILITY. (W70-08888).

00375. EUROPEAN PRACTICES IN SLUDGE DIGESTION AND DISPOSAL.

VATER, W.A.G.

WATER QUALITY IMPROVEMENT BY PHYSICAL AND CHEMICAL PROCESSES, UNIVERSITY OF TEXAS PRESS, AUSTIN, 1970, P 421-436.

EUROPEAN PRACTICES IN SLUDGE DEWATERING AND DISPOSAL ARE DISCUSSED CONSIDERING THOSE ASPECTS WHICH DIFFER FROM METHODS PRESENTLY USED IN THE UNITED STATES. THE DIFFERENCES BETWEEN EUROPEAN AND AMERICAN SLUDGE DISPOSAL PRACTICES ARE PRIMARILY THE RESULT OF COST DIFFERENCES. POWER COSTS FOR MUNICIPAL UTILITIES IS 2.5 CENTS/KW HR, CURRENT SELF-GENERATED FROM DIGESTER GAS 1.2 CENTS-KW3HR, FUEL OIL $0.10/GAL., CONSTRUCTION AND INSTALLATION COSTS FOR DIGESTERS IS APPROXIMATELY $50/M3 AND LABOR IS ABOUT $4000/YR. PASTEURIZATION PRIOR TO USE ON THE SOIL IS REQUIRED IF THE SLUDGE IS TO BE USED FOR IMPROVEMENT OF THE SOIL. COMPOSTING WITH REUSE IN WHICH SUFFICIENT SELF-HEATING IS GENERATED IS CONSIDERED AN EFFECTIVE HEATING OF THE LIQUID. MOST SLUDGE THICKENERS ARE TANKS WITH CIRCULAR CROSS SECTIONS. IF THEY ARE NOT EQUIPPED WITH THE SCRAPERS THE BOTTOM IS FUNNEL SHAPED WITH SLUDGE REMOVAL AT THE DEEPEST POINT. CONTINUOUS DECANTER CENTRIFUGES ARE MOST COMMONLY USED. IF NO CHEMICALS ARE ADDED THE RECOVERY IS 40-70% OF SOLIDS FROM THE RAW SLUDGE. THE AVERAGE VACUUM FILTER RATE IS ABOUT 5 GAL/SQ FT AND UNDER FAVORABLE CONDITIONS UP TO 7.5

GAL/SQ FT FOR SOLIDS CONTENT OF 10%. OF ALL AVAILABLE MECHANICAL SLUDGE DEWATERING EQUIPMENT, FILTER PRESSES YIELD THE GREATER POSSIBLE CAKE SOLIDS CONTENT. THE AVERAGE PERFORMANCE IS ABOUT 1 TO 2.5 GAL/SQ FT WITH SOLIDS CONTENT OF 10% AND CAKE SOLIDS CONTENT OF 40-60%. SLUDGE INCINERATION YIELDS THE SMALLEST POSSIBLE FINAL VOLUME OF ANY MECHANICAL SLUDGE HANDLING METHOD. INCINERATORS OF THE MULTIPLE HEARTH FURNACE AND FLUIDIZED BED TYPE ARE DISCUSSED. (W70-08895).

00376. ALGAL FLOCCULATION WITH ALUMINUM SULPHATE AND POLYELECTROLYTES.

MCGARRY, M.G.
J WATER POLLUTION CONTROL FED., 42(5), PART 2, R191-R207, 1970.

THE HIGH RATE POND PROCESS IS BEING DEVELOPED TO TREAT WASTE WATER AND PROVIDE A NEW SOURCE OF EDIBLE PROTEIN IN THE FORM OF ALGAE. AS A FOOD PRODUCTION PROCESS, THE YIELD OF ALGAE EXCEEDS THE YIELDS OF ALL CURRENTLY KNOWN GRAIN CROPS. RECENT STUDIES IN THAILAND HAVE INDICATED THAT PROTEIN PRODUCTION RATES OF 2K TONS/YEAR/ACRE ARE QUITE EASILY ACHIEVED ON A PILOT PLANT SCALE. THIS YIELD COMPARES FAVORABLY WITH THAT OF WHEAT, 135 LB/YEAR/ACRE AND THAT OF SOY BEANS 576 LB/YEAR/ACRE. ALUMINUM SULFATE WAS TESTED AS A PRIMARY COAGULANT IN CONJUNCTION WITH A VARIETY OF POLYELECTROLYTES FOR CHEMICAL FLOCCULATION AS A MEANS OF HARVESTING THE DISPERSED ALGAE FOR HEAVILY LADEN POND WATER. THE INDEPENDENT VARIABLES STUDIED WERE ALUM AND POLYELECTROLYTE CONCENTRATES, TIME OF POLYELECTROLYTE ADDITION, FAST AND SLOW MIXING PERIOD AND DEGREE OF TURBULENCE. DEPENDENT VARIABLES CONSIDERED WERE: SUPERNATANT TRANSMISSION AND SETTLED VOLATILES AS A MEASURE OF HARVEST OF ALGAE, AFTER ONE HOUR OF SETTLEMENT. COST OF ALGAL HARVESTING BY ALUM ALONE AT CONCENTRATIONS OF 30 MG/L WOULD BE PROHIBITIVE. THE OVERALL MINIMUM COST PER UNIT OF ALGAL YIELD WAS ATTAINED WITH ALUM ALONE AT DOSAGE RANGE OF 75 TO 100 MG/L OF ALUM. (W70-08904).

00377. SCUM INCINERATION EXPERIENCES.

ROSS, E.E.
J WATER POLLUTION CONTROL FED., 42(5), PART 1, 733-736, 1970.

THE EAST BAY WATER POLLUTION CONTROL SYSTEM OF OAKLAND, CALIFORNIA IS DESIGNED TO GIVE PRIMARY TREATMENT TO AN AVERAGE DRY WEATHER FLOW OF 128 MGD AND HANDLE A MAXIMUM OF 291 MGD. THE TREATMENT PROCESS CONSISTS OF PRE-CHLORINATION, SCREENING, GRIT REMOVAL, SEDIMENTATION, POST-CHLORINATION AND SLUDGE DIGESTION. DURING THE EARLY YEARS OF OPERATION IT WAS FOUND THAT THE SEDIMENTATION TANK SCUM WHICH WAS THEN PUMPED TO THE DIGESTION SYSTEM WITH RAW PRIMARY SLUDGE CONTAINED APPRECIABLE AMOUNTS OF PETROLEUM OIL, AND OTHER INDUSTRIAL WASTES WHICH WERE NOT READILY DIGESTIBLE. THIS PROBLEM INITIALLY LEAD TO THE INSTALLATION OF A GRAVITY FLOTATION TYPE THICKENER IN WHICH THE RAW SKIMMING AND DIGESTION SCUM WERE CONCENTRATED AND HAULED TO OFF-PLANT SANITARY FILLS. THE HIGH COST OF THIS METHOD OF DISPOSAL, IN EXCESS OF $12,000 ANNUALLY FOR HAULING ALONE RESULTED IN THE INSTALLATION IN 1964 OF AN INCINERATION PLANT. THE 10.75 FT. 6-HEARTH UNIT IS DESIGNED FOR 20 TON/DAY AND AUTOMATIC OPERATION TO MINIMIZE OPERATOR ATTENTION. TO MEET THE AIR POLLUTION CONTROL DISTRICT STANDARDS THE FURNACE WAS EQUIPPED WITH A CENTURI-TYPE WET SCRUBBER AND CYCLONIC SEPARATOR. THE HEAT VALUE OF THE SCUM ON A DRY BASIS IS BETWEEN 14,000 AND 16,000 BTU'S/LB. MOISTURE CONTENT VARIED FROM 48.6% TO 42.5% IM 1968. THE MAXIMUM TEMPERATURE MAINTAINED WITHIN THE FURNACE VARIES FROM 1500 TO 1800 DEG F. (W70-08908).

00378. CLARIFICATION-ADSORPTION IN THE TREATMENT OF MUNICIPAL AND INDUSTRIAL WASTEWATER.

HAGER, D.G.; REILLY, P.B.
J WATER POLLUTION CONTROL FED., 42(5), 794-800,, 1970.

OVER THE LAST THREE YEARS MANY LABORATORY AND FIELD EVALUATIONS HAVE CONFIRMED THE TECHNICAL AND ECONOMIC FEASIBILITY OF TREATING RAW MUNICIPAL WASTE WATER WITH GRANULAR ACTIVATED CARBON AFTER PRELIMINARY FLOCCULATION AND SETTLING CONDUCTED ON RAW WASTE WATER FROM 11 MUNICIPAL PLANTS LOCATED PRINCIPALLY IN WESTERN PENNSYLVANIA. THE RESULTS OF THESE TESTS ARE TABULATED IN TERMS OF TOTAL ORGANIC CARBON. THE POUNDS OF CARBON REQUIRED TO TREAT WASTE WATER ARE SHOWN AS POUNDS PER MILLION GALLONS AND INDICATE A WIDE RANGE BETWEEN 542 AND 4280 FOR 90% TOC REMOVAL AND BETWEEN 572 AND 5050 FOR 95% TOC REMOVAL. IT IS STATED THAT THE BREAK EVEN POINT WHEN COMPARING ECONOMICS OF ACTIVATED SLUDGE AND ACTIVATED CARBON IS A CARBON DOSAGE OF 300 TO 1000 POUNDS PER MILLION GALLONS. A COST COMPARISON IS GIVEN BETWEEN THE ACTIVATED SLUDGE SYSTEM FOR 10 MGD PLANT AT 90% BOD REMOVAL AND THE CLARIFICATION-ADSORPTION PROCESS FOR 95% REMOVAL. THE ACTIVATED SLUDGE PLANT CONSTRUCTION COST IS ESTIMATED AT 3.883 MILLION DOLLARS AS COMPARED TO 3.359 MILLION DOLLARS FOR ADSORPTION-CLARIFICATION PLANT. A SUMMARY OF THE OPERATING COSTS OF THE TWO SYSTEMS IS TABULATED. A TOTAL OF $0.091/1000 GALLONS IS PRESENTED FOR THE ACTIVATED SLUDGE SYSTEM AND $0.107/1000 GALLONS FOR THE CLARIFICATION-ADSORPTION SYSTEM. COMBINING OPERATING COSTS WITH AMORTIZATION OF CAPITAL THE TWO SYSTEMS ARE ESSENTIALLY IDENTICAL AMOUNTING TO $0.178/1000 GALLONS FOR ACTIVATED SLUDGE AND $0.179/1000 GALLONS FOR CLARIFICATION-ADSORPTION. (W70-08910).

00379. WATER CONSERVATION AND REUSE BY INDUSTRY.

IRVINE, R.L.; DAVIS, W.B.
WATER AND WASTES ENGINEERING, 7(1), 17-19, 1970.

THE CONCEPT OF WATER CONSERVATION AND REUSE WAS PRESENTED IN ORDER TO PROMOTE INDUSTRIAL IMPLEMENTATION OF INPLANT WATER MANANGMENT PROGRAMS. INDUSTRY HAS AVOIDED SUCH PROGRAMS; ASSUMING THAT THE QUANTITY AND QUALITY OF ITS WATER SUPPLY HAVE BEEN AND WILL BE CONSTANT IN TIME AND SPACE. WASTE TREATMENT AND ITS ASSOCIATED COST SEEMS TO BE GENERALLY FEARED. COST ANALYSES WERE PRESENTED THAT POINT OUT THE ECONOMIC BENEFITS OF CONSERVATION AND REUSE. IN ADDITION, PROCEDURES WERE DESCRIBED THAT INCREASE THE EFFICIENCY OF BIOLOGICAL WASTE TREATMENT FACILITIES. THE SEGREGATION OF WASTE STREAMS WAS STRESSED. ALSO, WITH THE IMPLEMENTATION OF CONSERVATION AND REUSE PROGRAMS, THE COST OF WASTE TREATMENT BECOMES PART OF THE PRODUCTION SCHEME. (W70-08960).

REFERENCE LIST

00380. WHAT THE WASTE PLANT ENGINEER SHOULD KNOW ABOUT CENTRIFUGES.

TOWNSEND, J.R.
WATER AND WASTES ENGINEERING, 6(11), 42-44, 1969

THE USE OF CENTRIFUGES IN WASTE WATER TREATMENT HAS INCREASED SIGNIFICANTLY IN RECENT YEARS. THE PRINCIPLES OF CENTRIFUGATION AND THE CAPABILITIES OF FOUR TYPES OF CENTRUFUGES, TUBULAR BOWL, DISC, DECANTER, AND SOLID-BOWL BASKET WERE DISCUSSED. THE FOLLOWING PARAMETERS WERE PRESENTED FOR EACH TYPE OF CENTRIFUGE, BOWL DIAMETER, FLOW RATE, SOLIDS INFEED, DISCHARGED SOLIDS, TEMPERATURE RANGE, PRESSURE RANGE, SPEED, GRAVITY, MOTOR POWER REQUIRED AND SIZE OF PARTICLES REMOVED. RELATIVE PERFORMANCES OF THE DISC, DECANTER AND SOLID-BOWL BASKET CENTRIFUGES ON A MUNICIPAL ACTIVATED SEWAGE SLUDGE WERE PRESENTED. ON THE ASSUMPTION THAT AN 85% RECOVERY OF PARTICLES IN AN ACTIVATED SLUDGE WAS SATISFACTORY, THE CAPITAL COSTS WERE CALCULATED. THE DISC CENTRIFUGE WAS FOUND TO HAVE THE LOWEST COST PER UNIT CAPACITY. FOR MAXIMUM SLUDGE CONCENTRATION, THE BASKET TYPE WAS FOUND TO BE SUPERIOR WHILE THE DECANTER CENTRIFUGE WAS FOUND TO BE POTENTIALLY ECONOMICAL ONLY WHEN USED WITH CHEMICAL TREATMENT. (W70-08974).

00381. DISPOSAL OF SLUDGE ON LAND.

EWING, B.B; DICK, R.I.
WATER QUALITY IMPROVEMENT BY PHYSICAL AND CHEMICAL PROCESSES, UNIVERSITY OF TEXAS PRESS, AUSTIN, 1970. P 394-408.

SLUDGE DISPOSAL ON LAND MAY BE APPLIED AS UNDIGESTED PRIMARY, AS EXCESS ACTIVATED SLUDGE, OR AS DIGESTED SLUDGE. IT MAY BE APPLIED AS A LIQUID OR IT MAY BE DEWATERED OR DRIED. THE LAND MAY BE USED SIMPLY AS A SITE FOR STOCKPILING SLUDGE FOR STORAGE. SLUDGE HAS LONG BEEN APPLIED TO LAND FOR LAND IMPROVEMENT USING THE HUMUS AND THE NUTRIENTS IN THE SLUDGE FOR SOIL CONDITIONING. RECENTLY INTEREST HAS BEEN SPARKED IN USE OF LAND APPLICATION OF LIQUID SLUDGE AS A MEANS OF SLUDGE TREATMENT AND DISPOSAL. THIS PRACTICE ALSO USED THE WATER FOR IRRIGATION. IF LAND DISPOSAL IS COMPARED WITH OTHER SLUDGE TREATMENT AND DISPOSAL COSTS INSTEAD OF CONSIDERING SLUDGE IN ECONOMIC COMPETITION WITH CHEMICAL FERTILIZERS AS A MEANS OF INCREASING A CROP PRODUCTION, IT BECOMES ECONOMICALLY ATTRACTIVE. CHEMICAL COMPOSITION OF SEWAGE SLUDGE IS ALSO TABULATED BEING BROKEN DOWN INTO TOTAL NITROGEN VARYING FROM 1.81 TO 5.96% TOTAL PHOSPATE P2O5 VARYING FROM 1.16 TO 6.97% TOTAL SOLUBLE K2O VARYING FROM 0.29 TO 0.56% AND ASH VARYING FROM 27.7 TO 61.4%. ODORS, FLIES, AND AESTHETIC DEGRADATION OF THE NEIGHBORHOOD SEEM TO BE THE COMPLAINTS MOST OFTEN VOICED. VARIOUS COSTS ARE GIVEN INCLUDING COSTS OF TRANSPORTATION OF SLUDGE FROM THE CITY BY RAILROAD TANK CAR, TANK TRUCK, PIPELINE. IN ADDITION THE COST OF SLUDGE DISPOSAL BY VARIOUS METHODS IS PRESENTED FOR LAND APPLICATION OF LIQUID, DIGESTED SLUDGE, DEWATERED SLUDGE TO LANDFILL, FERTILIZER PRODUCTION, INCINERATOR ASH TO LANDFILL. (W70-08893).

00382. PHOSPHORUS REMOVAL FROM EFFLUENTS IN ALUMINA COLUMNS.

AMES, L.L. JR.; DEAN, R.B.
J WATER POLLUTION CONTROL FED., 42(5), PART 2, R161-R172, 1970.

AN ALUMINA COLUMN TREATING A SYNTHETIC SECONDARY WASTE WATER EFFLUENT WAS STUDIED. SMALL 1.1-CM-DIAMETER BY 8-CM-HIGH COLUMNS WERE USED FOR THE STUDY. THE ALUMINA ADSORPTION PHENOMENA HAS BEEN CONSIDERED TO BE ESSENTIALLY A HIGHLY SELECTIVE ION EXCHANGE PROCESS WITH PHOSPHORUS ALSO INVOLVED IN A SECONDARY ADSOPRTION REACTION. AT 10% BREAKTHROUGH THE THROUGHPUTS FOR 10.3,7.0 AND 3.5 MG P/L IN THE STANDARD INFLUENT WERE 900, 1400 AND 1900 COLUMN VOLUMES RESPECTIVELY. THE COMPETITION OR EFFECTS OF OTHER ANIONS ON PHOSPHORUS REMOVAL WAS OF INTEREST BECAUSE LARGE CONCENTRATIONS OF OTHER ANIONS COULD SIGNIFICANTLY LOWER THE PHOSPHORUS CAPACITY OF THE ALUMINA. THE SULPHATE ION WAS CHOSEN TO DEMONSTRATE THE INTERFERING EFFECTS ON PHOSPHORUS CAPACITY. THE CONCENTRATION OF MAGNESIUM AND CALCIUM ALSO SHOWED MARKED EFFECTS ON ALUMINA COLUMN PHSOSPHORUS CAPACITY. ADSORPTION ON THE ALUMINA OCCURS PARTLY AS A CALCIUM OR MAGNESIUM PHOSPHORUS COMPLEX RATHER THAN A SIMPLE PHOSPHORUS ANION. ELUTION OF PHOSPHORUS WAS ACCOMPLISHED WITH 8 COLUMN VOLUMES OF 1 MOLAR SODIUM HYDROXIDE FOLLOWED BY 20 COLUMNS OF WASH WATER. ESTIMATED TREATMENT COST INCLUDING FILTRATION FOR A 10 MGD PLANT IS BETWEEN 5 AND 6 CENTS/1000 GALLONS FOR SECONDARY EFFLUENT CONTAINING 10 TO 12 MG P/L. (W70-08915).

00383. TECHNIQUES FOR ESTIMATING CONSTRUCTION COSTS OF WASTE TREATMENT PLANTS.

SHAH, K.L.; REID, G.W.
J WATER POLLUTION CONTROL FED., 42(5), PART 1, 776-793, 1970.

REGRESSION EQUATIONS BASED ON STATISTICAL TECHNIQUES HAVE BEEN DEVELOPED FOR ESTIMATING THE UNIT CONSTRUCTION COSTS OF MUNICIPAL WASTE TREATMENT PLANTS, BOTH IN TERMS OF DESIGN FLOW AND POPULATION EQUIVALENCY. REGIONAL DIFFERENCES WERE TAKEN INTO ACCOUNT IN ANALYZING THE DATA AND ALL REASONABLE COMBINATIONS OF VARIABLES WHICH WERE THOUGHT TO AFFECT COST WERE CONSIDERED. TWO METHODS HAVE BEEN USED TO DEVELOP EQUATIONS: (1) BY ANALYZING SEPARATELY THE DATA OF EACH TYPE OF PLANT, AND (2) BY COMBINING THE DATA AND USING DUMMY VARIABLES FOR THE TYPE OF TREATMENT PLANT. 809 LETTERS WITH QUESTIONNAIRE FORMS WERE MAILED INCLUDING 49 LETTERS TO STATE HEALTH DIRECTORS; 563 WERE COMPLETED. DATA ON 102 PRIMARY TREATMENT PLANTS WERE OBTAINED. THE RELATIONSHIPS BETWEEN THE VARIABLES: COST PER MILLION GALLONS AND FLOW IN MGD WERE DERIVED. FOR STABILIZATION PONDS ONLY 12 OF 157 PLANTS REPORTED CURRENT PERFORMANCE OF TREATMENT. SAMPLE SIZE FOR THE STANDARD RATE TRICKLING FILTER WAS 67 AND AN EQUATION IS DERIVED FOR ESTIMATING UNIT CONSTRUCTON COST IN TERMS OF DOLLARS PER MGD. DATA ON 120 HIGH-RATE TRICKLING FILTER PLANTS WERE OBTAINED. ACTIVATED SLUDGE TREATMENT PLANTS HAD A SAMPLE SIZE OF 115. THE DATA ON STANDARD RATE TRICKLING FILTER, HIGH-RATE TRICKLING FILTER, AND ACTIVATED SLUDGE PLANTS WERE COMBINED AND REGRESSION ANALYSIS WAS MADE WITH A SAMPLE SIZE OF 304. SINCE THE LOGARITHMIC TRANSFORMATION OF THE VARIABLES GAVE THE BEST

FIT, DUMMY VARIABLES WERE USED IN THIS FORM OF LINEAR EQUATION. (W70-08916).

00384. FEDERAL GRANTS AVAILABLE FOR INDUSTRIAL POLLUTION CONTROL.

LACY, W.J.; CYWIN, A.

WATER AND SEWAGE WORKS, 116(5), 12-15, 1969.

FEDERAL WATER POLLUTION CONTROL PROGRAMS ARE DESCRIBED WITH EMPHASIS BEING PLACED ON THE INDUSTRIAL RESEARCH AND DEVELOPMENT (RAND D) PROGRAM. THE PROGRAM'S GENERAL OBJECTIVE IS TO PROVIDE EACH BASIC INDUSTRY THE DEMONSTRATED, DEVELOPED, AND EVALUATED TECHNOLOGY FOR THE ABATEMENT OR PREVENTION OF WATER POLLUTION. THE R AND D PROGRAM INVOLVING RESEARCH, DEVELOPMENT AND DEMONSTRATION CONSISTS OF THREE COMPONENTS: AN IN-HOUSE EFFORT, A GRANTS PROGRAM AND A CONTRACT PROGRAM. MORE THAN 80% OF THE MONIES AVAILABLE TO THE FWPCA FOR R AND D ARE USED IN THE FORM OF GRANT AND CONTRACT PAYMENTS. INDUSTRY CAN NOW APPLY FOR GRANTS WHICH PAY AS MUCH AS 70% OF PROJECT COST UP TO $1 MILLION. THE SEQUENCE OF REVIEW FOR GRANT PROPOSALS IS OUTLINED. SEVERAL INDUSTRIAL GRANTS ARE DESCRIBED. PROJECTED SCHEDULES OF INVESTMENTS IN WASTE TREATMENT FACILITIES BY INDUSTRY AND GENERALIZED COST RANGES FOR TREATMENT PROCESSES FOR SOME INDUSTRIES ARE SUMMARIZED. IT IS ESTIMATED THAT INDUSTRIAL WASTE TREATMENT COSTS OVER THE NEXT FIVE YEARS WILL BE $2.6 TO 4.6 BILLION. JOINT INDUSTRIAL-MUNICIPAL TREATMENT IS ANOTHER R AND D PROGRAM AREA. GRANTS MAY BE AWARDED FOR AS MUCH AS 75% OF THE ESTIMATED REASONABLE COST OF THE PROJECT WHILE CONTRACTS MAY BE AWARDED FOR UP TO 100% OF THE PROJECT COST. (W70-08969).

00385. ODOR CONTROL METHODS, EXPERIMENTATION AND APPLICATION.

KREMER, J.G.

LOS ANGELES COUNTY SANITATION DISTRICT, REPORT, 1969. 71 P.

DESCRIBES THE FIELD AND LABORATORY INVESTIGATIONS CONDUCTED BY THE COUNTY OF LOS ANGELES SANITATION DISTRICTS TO DEVELOP METHODS, PROCEDURES AND EQUIPMENT FOR ODOR CONTROL OF AIR FLOWS FROM WASTEWATER TREATMENT PLANTS. THE OBJECTIVES OF THE PROJECT WERE TO: DEVELOP MEANS TO QUANTITATIVELY EVALUATE ODOR CONCENTRATIONS; FORMULATE SYSTEMS FOR REMOVING ODORS; EVALUATE THE SYSTEMS FOR PRACTICALITY AND EFFECTIVENESS; AND DETERMINE COSTS OF ODOR REMOVAL. A LITERATURE SEARCH REVEALED SCANT KNOWLEDGE OF PRACTICAL METHODS OF ODOR CONTROL. A SPECIAL ODOR EVALUATION ROOM WAS CONSTRUCTED AND EQUIPPED FOR ODOR EVALUATIONS BY MALE AND FEMALE STUDENTS FROM A NEARBY COLLEGE. PILOT PLANTS WERE CONSTRUCTED AND TESTED TO EVALUATE VARIOUS METHODS OF REMOVING ODORS FROM AIR FLOWS OF WASTE WATER. THESE INCLUDED: A CONVENTIONAL ACTIVATED SLUSGE SCRUBBER; A PACKED-TOWER TURBULENT CONTACT LIQUID SCRUBBER USING ACTIVATED SLUDGE AND VARIOUS CHEMICALS; AND ACTIVATED CARBON ABSORBTION. COST COMPARISONS, ADVANTAGES, AND CAPACITIES ARE DESCRIBED FOR THE ABOVE METHODS AND FOR FUME INCINERATION. A SUCCESSFUL APPLICATION OF ACTIVATED CARBON FOR ODOR REMOVAL WAS MADE AT A WASTE WATER PUMPING STATION. (W70-09190).

00386. SPACE HEATING IN URBAN ENVIRONMENTS.

MILLER, A.J.

OAK RIDGE NATIONAL LABORATORY, TENN., TID DOCUMENT NO. CONF-680810, 219-237, 1968.

REPORTS THE PRELIMINARY FINDINGS OF A SYSTEMS ANALYSIS OF THE USEFULNESS OF NUCLEAR ENERGY CENTERS IN OR NEAR LARGE CITIES AND THE APPLICATION OF ENERGY CENTERS TO THE DEVELOPMENT PATTERNS AND PROBLEMS OF AMERICAN CITIES. IT IS CONCLUDED THAT IN 1980 THE HEAT FROM A NUCLEAR ENERGY CENTER COULD BE USED TO HEAT AND AIR-CONDITION A LARGE PORTION OF A LARGE CITY AT A COST PER UNIT OF HEAT EQUIVALENT TO THAT NOW INCURRED BY DISTRICT HEATING IN DOWNTOWN COMMERCIAL AND HIGH-RISE APARTMENT AREAS. THE AREAS SERVED COULD BE MUCH LARGER AND THEY COULD CONSUME MUCH LESS HEAT PER UNIT OF AREA THAN THOSE NOW SERVED IN THIS COUNTRY BY DISTRICT-HEATING SYSTEMS. HEAT FROM BACK-PRESSURE STEAM AND TURBINE BLEED WOULD BE USED RATHER THAN HEAT FROM PRIME STREAM. THEREFORE THE WASTE OF HEAT FROM THE PLANT GENERATING ELECTRICITY WOULD BE SIGNIFICANTLY REDUCED. SUCH A SYSTEM WOULD REDUCE BOTH CHEMICAL POLLUTION OF THE AIR AND THERMAL POLLUTION OF STREAMS. CALCULATIONS INDICATE THAT DISTRIBUTION PIPING SYSTEMS COULD BE EXTENDED TO SERVE LARGER AREAS ECONOMICALLY, AND THAT THE USE OF MEDIUM OR HIGH TEMPERATURE WATER WOULD BE MOE ECONOMICAL THAN HIGH-PRESSURE STEAM. INVESTIGATIONS OF SYSTEM RELIABILITY, TIME VARIATION IN LOAD, ECONOMICS, GEOGRAPHICAL INFLUENCES, AND ACCURACY OF CALCULATIONS ARE RECOMMENDED. (W70-09192).

00387. BAFFLED BIOLOGICAL BASIS FOR TREATING POULTRY PLANT WASTES.

NEMEROW, N.L.

J WATER POLLUTION CONTROL FED., 41(9), 1605-1612, 1969.

A POULTRY PLANT IN MILLSBOROUGH, DELAWARE, PROCESSED 10,000 CHICKENS PER HOUR WITH A WASTE WATER OF 40,000 GPH, AND AN EFFLUENT OF 2,500 LB BOD5/DAY AT AN AVERAGE BOD OF 630 MG/L. BECAUSE THE AREA IS COMMERCIALLY AND RECREATINALLY OF GREAT VALUE A PROGRAM WAS INITIATED TO REDUCE THE WASTE WATER CONCENTRATION AT A MAXIMUM COST OF $100,000. ADEQUATE SCREENING FOLLOWED BY A TWO-STAGE OXIDATION POND PLANT UTILIZING OVER AND UNDER CONTACT BAFFLES IN THE FIRST STAGE FOLLOWED BY CHLORINATION PROVIDED 85 TO 95% BOD REDUCTIONS. THE SECOND STATE IS A SHALLOW SYNTHETIC BASIN. LOADINGS OF OVER 200 LB/DAY/ACRE RESULTED IN HIGH EFFICIENCY AND COLIFORM COUNTS OF LESS THAN 10/1000 ML. THE FINAL COST WAS $90,000. (W70-09320).

00388. PROBLEM: HARBOR DEBRIS.

CONNER, E.B.

WATER SPECTRUM, ISSUES, CHOICES, ACTIONS, 2(1), 9-13, SPRING 1970.

DE-LITTERING IN THE NATION'S 250 HARBORS AND CHANNELS IS A STAGGERING CHORE. IN A SURVEY OF NEW YORK'S HARBOR AND TRIBUTARIES, 2,000 ABANDONED VESSELS AND OVER 2,300 SHORE STRUCTURES AND CLUSTERS OF FLOATABLE DEBRIS WERE FOUND TO BE POTENTIAL DRIFT SOURCES. SWEEPING BOATS REMOVED SOME DEBRIS BUT THOUSANDS OF ACCIDENTS STILL OCCURRED EVERY YEAR CAUSING EXPENSIVE DAMAGE AND

DANGER. TWO GENERAL APPROACHES OFFERED SOLUTIONS TO THE DRIFT PROBLEM: (1) TO INCREASE REMOVAL AND DISPOSAL OF FLOATING DEBRIS ABOVE PRESENT LEVEL, AND (2) TO ELIMINATE THE SOURCES OF DRIFT BY REMOVAL OR REPAIR OF DERELICT VESSELS AND STRUCTURES. COST-BENEFIT ANALYSIS SHOWED THE LATTER TO BE BEST. COSTS OF REMOVAL AND REPAIR WERE ESTIMATED AT $29 MILLION AND AN ANNUAL COST OF 1.5 MILLION, WHILE MONETARY BENEFITS WOULD BE OVER $10 MILLION A YEAR AS WELL AS OTHER BENEFITS OF REDUCTION IN FIRE HAZARDS, AIR AND WATER POLLUTION, HAZARDS TO LIFE AND HEALTH AND IMPROVED APPEARANCE OF THE WATERFRONT. A NATIONAL SURVEY RECOMMENDS AN AGGRESSIVE PROGRAM TO REMOVE SOURCES OF DRIFT. SUCH A PROGRAM OFFERS AN OPPORTUNITY FOR COOPERATION BETWEEN FEDERAL, STATE AND LOCAL GOVERNMENTS TO IMPROVE THE QUALITY OF URBAN ENVIRONMENT. SUCCESSFUL IMPLEMENTATION, REQUIRING ENACTMENT AND ENFORCEMENT OF LOCAL ORDINANCES TO REGULATE SOURCES OF DRIFT, WOULD GREATLY HELP IN RELIEVING CONDITIONS OF WATERFRONT DECAY, UGLINESS AND BLIGHT, FREE WATERSIDE SITES FOR FUNCTIONS HAVING POSITIVE EFFECTS ON THEIR NEIGHBORHOOD AREAS; AND BRING ABOUT HIGHER LEVELS OF USEFULNESS AND SAFETY FOR BOTH COMMERCIAL AND RECREATIONAL USERS OF OUR NATION'S VITAL WATERWAYS AND HARBORS. (W70-09640).

00389. OPTIMAL TAXING FOR THE ABATEMENT OF WATER POLLUTION.

HASS, J.E.
WATER RESOURCES RESEARCH, 6(2), 353-365, 1970.

THIS PAPER IS CONCERNED WITH THE USE OF TAXES TO INTERNALIZE THE COSTS OF POLLUTION. THE ANALYSIS CONSIDERS THE ROLE OF A CENTRAL AUTHORITY AND PROVIDES JUSTIFICATION FOR THE IMPOSITION OF POLLUTION TAXES TO ELICIT OPTIMAL TREATMENT BEHAVIOR FROM EACH POLLUTER WITHIN A BASIN. THE AUTHOR THEN DERIVES A RUDIMENTARY RIVER BASIN MODEL THAT INCORPORATES THE FUNDAMENTAL HYDROLOGICAL CHARACTERISTICS OF THE BASIN, THE IMPOSITION OF DISSOLVED OXYGEN STANDARDS, AND THE EFFECTS OF TREATMENT OF ORGANIC WASTE AND LOW AUGMENTATION ON THE DISSOLVED OXYGEN CONTENT OF A RIVER. THIS IS A MATHEMATICAL PROGRAMMING MODEL WHICH MUST BE SOLVED BY THE CENTRAL AUTHORITY. THE ANALYSIS FUTHER DEMONSTRATES HOW THE DANTZIG-WOLFE NON-LINEAR DECOMPOSITION ALGORITHM CAN BE USED TO ACHIEVE THE STANDARDS IMPOSED AT MINIMUM COST TO SOCIETY AND TO DETERMINE THE TAX STRUCTURE REQUIRED TO ACHIEVE THIS SOLUTION. (W70-09652).

00390. MIXED LIQUOR SOLIDS SEPARATION BY FLOTATION.

MULBARGER, M.C.; HUFFMAN, D.D.
JOURNAL OF THE SANITARY ENGINEERING DIVISION, PROCEEDINGS OF THE AMERICAN SOCIETY OF CIVIL SLUDGE ENGINEERS, 96(SA4) P 861-870, 1970.

A FULL-SCALE DISSOLVED AIR FLOTATION UNIT DESIGNED FOR SOLIDS-LIQUID SEPARATION OF AN ACTIVATED SLUDGE MIXED LIQUOR WAS EVALUATED IN A FIELD INVESTIGATION. THE DATA INDICATED THAT CONVENTIONAL DESIGN PARAMETERS DO NOT ADEQUATELY PREDICT FLOTATION PERFORMANCE IN TERMS OF EFFLUENT SUSPENDED SOLIDS. A NEW PARAMETER WAS DEVELOPED AND IS PROPOSED AS A RATIONAL DESIGN GUIDELINE. CONVENTIONAL DESIGN CRITERIA SUCH AS THE SOLIDS LOADING RATE AND AIR SOLIDS RATIO DID NOT DESCRIBE FLOTATION PERFORMANCE IN TERMS OF THE EFFLUENT SUSPENDED SOLIDS. A COST-QUALITY COMPARISON OF FLOTATION VERSUS GRAVITY SEDIMENTATION WITH WASTE SLUDGE THICKENING INDICATED THAT OVERALL PLANNING AND PERFORMANCE COULD HAVE BEEN IMPROVED FOR A SUBSTANTIAL ECONOMIC SAVINGS. A SAVINGS IN TANKAGE VOLUME AND AREA REQUIREMENTS WOULD HAVE RESULTED FROM THE USE OF CONVENTIONAL GRAVITY CLARIFIER WITH OR WITHOUT WASTE SLUDGE THICKENING. IF GRAVITY SEDIMENTATION HAD BEEN USED, THE TOTAL COSTS INDICATED THAT THE EXPENDITURES ASSOCIATED WITH MIXED-LIQUOR SOLID SEPARATION WULD HAVE BEEN APPROXIMATELY 30% OF THE FLOTATION COSTS. AS COMPARED TO THE USE OF A FLOTATION UNIT ALONE, THE COMBINATION OF GRAVITY SEDIMENTATION AND WASTE SLUDGE THICKENING BY FLOTATION WOULD HAVE PRODUCED A SAVINGS OF ABOUT 48% OR $0.03 PER THOUSAND GALLONS. (W70-10026).

00391. FILTRATION OF ALGAL SUSPENSIONS.

WRIGHT, I.J.; LUIZ, W.M.
BOHNA ENGINEERING AND RESEARCH, INCORPORATED, SAN FRANCISCO, CALIFORNIA, BOHNA INTERNAL REPORT F170, 1970. 31 P.

THE SANBORN FILTER, PROPRIETARY OF BOHNA ENGINEERING AND RESEARCH, INC, A FABRIC AND GRANULAR-MEDIA DEVICE, HAS BEEN EVALUATED FOR USE IN HARVESTING ALGAE FROM PONDS. REMOVALS OF UP TO 98% HAVE BEEN ACHIEVED WITHOUT THE USE OF FLOCCULANTS OR OTHER CHEMICAL ADDITIVES. AN ECONOMIC ANALYSIS OF THE USE OF ALGAE FOR NITROGEN STRIPPING WAS MADE. ASSUMING A FLOW SHEET WHICH INCLUDES LINED, MIXED GROWTH PONDS FOLLOWED BY FILTRATION WITH THE SANBORN FILTER, CONCENTRATION OF THE BACKWASH BY SEDIMENTATION OR CENTRIFUGATION AND AIR DRYING OF THE ALGAE, AN APPROXIMATE TOTAL COST OF $37.01 PER MILLION GALLONS TREATED IS PROJECTED, BASED ON AMORTIZATION AND INTEREST CHARGES OF 10% PER YEAR OF THE INITIAL INVESTMENT. CAPACITY OF 700 MILLION GALLONS PER DAY WAS ASSUMED. (W70-10174).

00392. ACTIVABLE RARE EARTH ELEMENTS ESTUARINE WATER TRACERS.

CHANNEL, J.K.; KRUGER, P.
FIFTH INTERNATIONAL WATER POLLUTION RESEARCH CONFERENCE, SAN FRANCISCO, JULY 26-AUG 1, 1970. 20 P.

A RELIABLE ANALYTICAL METHOD HAS BEEN DEVELOPED FOR SEPARATING THE RARE-EARTH ELEMENTS (REE) AS A GROUP FROM ESTUARINE WATER AND DETECTING EUROPIUM AND LANTHANUM IN QUANTITIES AS LOW AS 1 NG AND 20 NG PER SAMPLE. ALTHOUGH REE MAY ADSORP TO SUSPENDED SOLIDS AT NORMAL PH, THE ANALYTICAL METHOD MEASURES THESE TOGETHER WITH THOSE IN SOLUTION. LOSSES TO BOTTOM SEDIMENTS CAN BE ESTIMATED AND ARE NOT SERIOUS FOR ESTUARIES WITH AVERAGE DEPTHS GREATER THAN 10 FT. THESE CHARACTERISTICS ENABLE REE TO BE USED IN TRACING THE DISSOLVED, SUSPENDED SOLIDS, AND SETTLEABLE SOLIDS PHASES OF SEWAGE EFFLUENT. ESTUARINE WATER CAN ALSO BE TRACED IF REE ARE INJECTED AT A LOW PH IN AREAS OF LOW SUSPENDED SOLIDS CONCENTRATION. THE ACTIVABLE REE CAN ALSO BE USED AS MULTIPLE TRACERS OR TO EXTEND THE RANGE OF FLUORESCENT DYE OR RADIONUCLIDE TRACERS. THE MINIMUM DETECTABLE AMOUNT OF ADDED TRACER IS 110 NG/L FOR LANTHANUM AND 15 NG/L FOR EUROPIUM. LANTHANUM TRACER IS LESS EXPENSIVE THAN RHODAMINE WT DYE IN

LARGE STUDIES. ESTIMATED LANTHANUM COSTS ARE SLIGHTLY GREATER THAN TRITIUM OF LA140 FOR LARGE STUDIES BUT MAY BE PREFFERABLE BECAUSE OF RADIOLOGICAL HEALTH CONSIDERATIONS. EUROPIUM IS NOT ECONOMICALLY COMPETITIVE. (W70-10210).

00393. TASK II REPORT: SURVEY OF POWER PLANT OPERATING CHARACTERISTICS AND DESIGN CRITERIA.

FULLER, W.D.; MAULBETSCH, J.S.
FEDERAL WATER QUALITY ADMINISTRATION, WATER POLLUTION CONTROL RESEARCH SERIES, AUGUST 1970. 94 P.

THIS REPORT IS PART OF A LARGER STUDY TO PERFORM A TECHNICAL AND ECONOMIC SURVEY OF ALTERNATE METHODS FOR COOLING CONDENSER DISCHARGE WATER FROM THERMAL POWER PLANTS. THE TASK REPORTED ON IN THIS DOCUMENT INVESTIGATES THE CRITERIA BY WHICH THE POWER PLANTS THEMSELVES ARE DESIGNED AND OPTIMIZED. THESE CRITERIA ARE BOTH TECHNOLOGICAL AND ECONOMIC. THE INITIAL SECTION REVIEWS THE GENERAL ASPECTS OF POWER PLANT SELECTION. THESE INCLUDE QUESTIONS SUCH AS HOW THE PROCEDURE OF PROCURING A NEW PLANT IS INITIATED, HOW THE PLANT SIZE IS DETERMINED, WHAT FACTORS INFLUENCE THE CHOICE OF FUEL AND SITE LOCATION, AND HOW THE PLANT CAPACITY FACTOR AND FIXED CHARGE RATE ARE CALCULATED. THERE FOLLOWS A DETAILED REVIEW OF DESIGN AND COST OPTIMIZATION PROCEDURES. THIS INCLUDES A REVIEW OF CAPITAL COSTS FOR THE TURBINE-GENERATOR UNITS AND FOR THE BOILERS. OPERATING COSTS ARE COMPUTED BASED ON CONSTANT INCREMENTAL RUNNING RATES. A WORKED EXAMPLE IS PRESENTED AND CARRIED TO THE POINT OF A 'PRESENT WORTH' EVALUATION. A BRIEF DISCUSSION OF THE USE OF FEEDWATER HEATERS, SINGLE- AND MULTI-PRESSURE CONDENSERS IS PROVIDED. SOME OPERATIONAL CONSIDERATIONS INCLUDING INSTRUMENTATION AND CONTROL AND PLANT LAYOUT ARE DISCUSSED BRIEFLY. A SEPARATELY BOUND APPENDIX INCLUDES A HEAT RATE TABLE FOR GENERAL ELECTRIC TURBINES, AND WESTINGHOUSE AND GENERAL ELECTRIC PRICE LISTS FOR BOTH CONVENTIONAL AND NUCLEAR TURBINE-GENERATOR UNITS. (W70-10346).

00394. AUTOMATIC WATER AND WASTE TREATMENT PLANTS IN OPERATION.

STONE, R.; CONRAD, E.T.
CIVIL ENGINEERING, 40(5), 37-40, 1970.

WATER AND WASTE TREATMENT FOR THE NAPA-BERRYESSA IMPROVEMENT DISTRICT AND LAKE BERRYESSA IN CALIFORNIA DEPEND ON AN AUTOMATIC SYSTEM. THE WATER FACILITIES ARE AN INTAKE STRUCTURE; TREATMENT PLANT WHICH PROVIDES FOR TASTE, ODOR, AND PH CONTROL, CLARIFICATION, FILTRATION AND CHLORINATION; PUMP STATION; 7,000 FT TRANSMISSION MAIN, STORAGE TANK, AND DISTRIBUTION SYSTEM. THE ENTIRE WATER SYSTEM IS CONTROLLED AUTOMATICALLY USING WATER LEVELS AT VARIOUS POINTS TO START AND STOP THE INTAKE AND BOOSTER PUMP STATIONS. THE INTAKE PUMPS ARE MOUNTED ON A CARRIER AND MOVE UP AND DOWN WITH THE LAKE LEVEL. THE SYSTEM WAS DESIGNED FOR PEAK FLOWS OF 0.5 MGD, EXPANDABLE TO 1.0 MGD AND ULTIMATELY TO 4.0 MGD. THE SEWAGE FACILITY TREATS A LOAD OF 0.175 MGD WITH EASY EXPANSION TO 0.35 MGD INCORPORATING AN ACTIVATED SLUDGE PLANT FOLLOWED BY OXIDATION BASINS. TWO BOOSTER PUMPS, CONTROLLED AUTOMATICALLY BY THE LEVEL IN THE OXIDATION BASIN, PUMP THE EFFLUENT TO THE DISPOSAL AREA. THE TREATED WASTE IS DISPOSED THROUGH HILLSIDE IRRIGATION EMPLOYING 80 ACRES WITH NATURAL SLOPES UP TO 1: 1. THE LAND WAS DIVIDED INTO FOUR SUBDIVISIONS, THREE SECTIONS INTERMITTENTLY IRRIGATED BY AUTOMATICALLY CONTROLLED 50,000 GAL STORAGE TANK, AND THE FOURTH SECTION ALLOWED TO FULLY DRY BETWEEN DOSINGS. DRAINAGE DITCHES AND A COLLECTION POND PREVENT CONTAMINATION OF LAKE WATERS. THE TOTAL CONSTRUCTION COST WAS $735,644 WITH $32,324 GOING FOR THE AUTOMATIC CONTROL SYSTEM. (W70-10328).

00395. WATER REUSE AND RECYCLING IN INDUSTRY.

ELLER, J.; FORD, D.L.; GLOYNA, E.F.
JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 62(3), 149-154, 1970.

THE CURRENT STATUS OF INDUSTRIAL WATER REUSE AND RECYCLING WAS SURVEYED BY A PRESENTATION OF REPRESENTATIVE CASE STUDIES. IN THE MAJORITY OF CASES INVOLVING INDUSTRIAL REUSE IT IS NECESSARY TO PROVIDE SOME FORM OF TREATMENT AND SEVERAL INDUSTRIES ARE USING SEVERAL FORMS OF TERTIARY TREATMENT IN SUPPORT OF WATER REUSE AND RECYCLE PRACTICES. PARTICULAR EMPHASIS IS PLACED ON REUSE OF MUNICIPAL WASTE WATERS BY SELECTED INDUSTRIES. AN ECONOMIC BALANCE EQUATION ON WATER REUSE WAS DISCUSSED AND A SIMPLIFIED MODEL ESTABLISHING A BASIS FOR MAKING ECONOMICDECISIONS PRESENTED. (W70-10329).

00396. PRESSURE FILTRATION OF SECONDARY TREATMENT PLANT EFFLUENT.

BERG, E.L.; BRUNNER, A.
WATER AND WASTES ENGINEERING, 6(10), 54-58, 1969.

A FIELD STUDY USING A COMMERCIAL PRESSURE FILTER TO CLARIFY SECONDARY TREATMENT PLANT EFFLUENT IS DESCRIBED. TWO DIFFERENT FILTER BEDS WERE EVALUATED: A SINGLE MEDIUM FILTER CONSISTING OF 20 INCHES ANTHRACITE COAL (EFFECTIVE SIZE 0.75 MM) AND A DUAL-MEDIA FILTER CONSISTING OF 6 INCHES SAND (EFFECTIVE SIZE 0.45 MM) AND 14 INCHES ANTHRACITE COAL. FILTRATION RATES WERE EITHER 5 OR 10 GPM/SQ FT AND FILTER PERFORMANCE WAS DETERMINED BY MEASUREMENT OF FILTER HEADLOSS, INFLUENT SUSPENDED SOLIDS AND EFFLUENT TURBIDITY. FOUR DIFFERENT POLYELECTROLYTES WERE INVESTIGATED IN CONJUNCTION WITH VARIED ALUM DOSAGES. RESULTS INDICATED THAT CATIONIC POLYELECTROLYTES WERE MORE EFFECTIVE IN PREVENTING FLOC BREAKTHROUGH THAN WERE THE NONIONIC OR ANIONIC POLYELECTROLYTES FOR THE SINGLE MEDIUM FILTER USING DOSAGES OF 2.16 MG/L POLYELECTROLYTES AND 14.5 MG/L ALUM AT A FILTRATION RATE OF 10 GPM/SQ FT. TOTAL ORGANIC CARBON (TOC) REMOVAL WAS 50% AND PHOSPHATE REMOVAL WAS 17%. SLIGHTLY BETTER TOC REMOVAL AND SIGNIFICANTLY LESS PHOSPHORUS REMOVAL WAS OBSERVED IN THE DUAL MEDIA FILTER UNDER SIMILAR CONDITIONS. ESTIMATES FOR A 1 MGD CAPACITY PLANT INDICATED A TOTAL COST OF 6.7 CENTS PER 1000 GALLONS FOR THIS TYPE TREATMENT. (W70-10343).

REFERENCE LIST

00397. DEMINERALIZATION OF WASTE WATER BY ION EXCHANGE.

PARKHURST, J.D.; CHEN, C.; CARRY, C.W.; MASSE, A.N.

FIFTH INTERNATIONAL WATER POLLUTION RESEARCH CONFERENCE, SAN FRANCISCO, JULY 26-AUGUST 1, 1970. PREPRINT, PAPER I-20.

AN ION EXCHANGE PILOT PLANT WAS SUCCESSFULLY DEMINERALIZED WASTE WATER AT POMONA, CALIFORNIA, FOR ALMOST THREE YEARS. COST ESTIMATES FOR THE ION EXCHANGE PROCESS SHOWS THAT BLENDED WATER WITH 1/3 THE INFLUENT TOTAL DISSOLVED SOLIDS REMOVED CAN BE PRODUCED AT A COST COMPETITIVE WITH ALTERNATIVE SOURCES OF WATER IN SOUTHERN CALIFORNIA. THE SYSTEM CONSISTS OF A TWO STAGE ION EXCHANGE PROCESS WHICH REDUCES THE INFLUENT TDS BY 90%. AFTER 500 CYCLES OF OPERATION NO DISCERNABLE DECREASE IN EFFICIENCY OF THE UNIT HAS OCCURRED. ACTIVATED CARBON ABSORPTION REGENERATION LEVELS ARE 1.1 LBS OF SULPHURIC ACID PER CUBIC FOOT FOR THE CATION RESIN AND 0.56 LBS OF AQUEOUS AMMONIA FOR THE ANION RESIN. THESE HAVE PRODUCED REGENERATION EFFICIENCIES OF 85 TO 90% RESPECTIVELY. BRINES TOTAL APPROXIMATELY 11% OF THE INFLUENT FLOW AND BACKWASH WASTES TOTAL ABOUT 4%, BUT THESE CAN BE RECYCLED THROUGH THE PRETREATMENT SYSTEM. ESTIMATED COSTS INCLUDING CARBON PRETREATMENT TO PRODUCE A BLENDED WATER OF 667 MG/L TDS FROM AN INFLUENT STREAM OF 1,000 MG/L TDS IS ABOUT 23 CENTS PER THOUSAND GALLONS. (W70-10400).

00398. ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS.

MARSHE, D.M.

COMBINED SEWER OVERFLOW ABATEMENT TECHNOLOGY, A COMPILATION OF PAPERS PRESENTED AT THE FEDERAL WATER QUALITY ADMINISTRATION 'SYMPOSIUM ON STORM AND COMBINED SEWER OVERFLOWS', P 57-106, JUNE 22-23, 1970.

THIS STUDY SOUGHT TO DETERMINE THE FEASIBILITY, EFFECTIVENESS, AND ECONOMICS OF EMPLOYING HIGH-RATE, LINE-MESH SCREENING FOR PRIMARY TREATMENT OF STORM WATER OVERFLOW FROM COMBINED SEWER SYSTEMS. THE FINAL FORM OF THE SCREENING UNIT STANDS 63 INCHES HIGH AND HAS AN OUTSIDE DIAMETER OF 80 INCHES. THE UNIT IS FED BY AN 8-INCH PIPE CARRYING 1700 GPM (122 GAL/MIN/FT SQ) WHICH IS DISTRIBUTED TO A 60-INCH DIAMETER ROTATING (60 RPM) STAINLESS STEEL COLAR SCREEN HAVING 14 SQUARE FEET OF AVAILABLE SCREEN AREA AND A 165 MESH (105 MICRON OPENING, 47.1 PERCENT OPEN AREA). THE SCREEN IS BACK-WASHED AT THE RATE OF 0.235 GALLONS OF BACKWASH WATER PER 1000 GALLONS OF APPLIED SEWAGE. BASED ON FINAL PERFORMANCE TESTS RUN ON DRY-WEATHER SEWAGE, THE UNIT IS CAPABLE OF 99 PERCENT REMOVAL OF FLOATABLE AND SETTLEABLE SOLIDS, 34 PERCENT REMOVAL OF TOTAL SUSPENDED SOLIDS AND 27 PERCENT REMOVAL OF COD. THE SCREENED EFFLUENT IS TYPICALLY 92 PERCENT OF THE INFLUENT FLOW. ON THE BASIS OF A SCALE-UP DESIGN OF A 25 MGD SCREENING FACILITY, THE ESTIMATED COST OF TREATMENT IS 22 CENTS/1000 GALLONS. NO FINITE COST COMPARISONS WERE MADE WITH OTHER TREATMENT METHODS; HOWEVER, WHEN COMPARED TO CONVENTIONAL PRIMARY SEDIMENTATION, THE SELECTION OF A SCREENING FACILITY AS A TREATMENT METHOD IS DEPENDENT ON THE VALUE AND AVAILABILITY OF LAND, THE DESIGN CAPACITY OF THE TREATMENT FACILITY, THE CHARACTER OF RAINFALL AND RUNOFF, AND THE MEANS OF DISINFECTION. IT WAS OBSERVED THAT THE PROPOSED SCREENING FACILITY REQUIRED 1/10 TO 1/20 THE LAND REQUIRED BY A CONVENTIONAL PRIMARY TREATMENT PLAN. (W70-09616).

00399. DETROIT SEWER MONITORING AND REMOTE CONTROL. DETROIT METR[illegible]LITAN WATER SERVICES, MICH.

COMBINED SEWER OVERFLOW ABATEMENT TECHNOLOGY, A COMPILATION OF PAPERS PRESENTED AT THE FEDERAL WATER QUALITY ADMINISTRATION 'SYMPOSIUM ON STORM AND COMBINED SEWER OVERFLOWS,' P 219-290, JUNE 22-23, 1970. 33 FIG, 4 TAB. FWQA PROJECT 11020 FAX.

DETROIT IS FACED WITH THE PROBLEM OF PREVENTING POLLUTION OF THE DETROIT AND ROUGE RIVERS FROM ITS COMBINED SEWER SYSTEM OVERFLOWS. AS AN ALTERNATIVE TO UNDERTAKING A DUBIOUSLY EFFECTIVE SEWER SEPARATION PROGRAM, ESTIMATED TO COST IN EXCESS OF TWO BILLION DOLLARS, THE DETROIT METRO WATER DEPARTMENT HAS INSTALLED THE NUCLEUS OF A SEWER MONITORING AND REMOTE CONTROL 'SYSTEM' FOR CONTROLLING THE POLLUTION FROM THE COMBINED OVERFLOW FROM MANY SMALL STORMS AT A COST OF SLIGHTLY OVER TWO MILLION DOLLARS. THE 'SYSTEM' INCLUDES TELEMETERING RAIN GAGES, SEWER LEVEL SENSORS, OVERFLOW DETECTORS, A CENTRALLY LOCATED COMPUTER AND DATA-LOGGER, AND A CENTRALLY LOCATED OPERATING CONSOLE FOR CONTROLLING PUMPING STATIONS AND SELECTED REGULATING GATES. INSTALLATION HAS BEEN VIRTUALLY COMPLETED AND NOW ENABLES APPLYING SUCH POLLUTION CONTROL TECHNIQUES AS 'STORM FLOW ANTICIPATION,' 'FIRST FLUSH INTERCEPTION,' 'SELECTIVE RETENTION,' AND 'SELECTIVE OVERFLOWING.' AN EVALUATION OF THE EFFECTIVENESS OF THIS INITIAL INSTALLATION WILL SERVE AS THE BASIS FOR DETERMINING WHAT ADDITIONAL POLLUTION CONTROL FACILITIES ARE REQUIRED, WHAT SUBURBAN MONITORING AND REMOTE CONTROL IS ESSENTIAL, WHAT COMPUTER RELATED EQUIPMENT FOR PUMP AND VALVE CONTROL CAN BE USED FOR MORE EFFECTIVE POLLUTION CONTROL, WHAT AUTOMATIC SAMPLING AND ANALYSIS WILL BE MORE VALUABLE IN THE SYNCHRONOUS OPERATION OF THE SEWERAGE SYSTEM AND WHAT DESIGN PARAMETERS SHOULD BE USED IN THE CONSTRUCTION OF NEW OR SUPPLEMENTAL SEWERS OR TREATMENT FACILITIES. (W70-09620).

00400. OPTIMAL DEGREE OF SEWAGE WATER TREATMENT FOR EACH PROJECT OF THE COMPLEX.

BELICHENKO, Y.P.

FIFTH INTERNATIONAL WATER POLLUTION RESEARCH CONFERENCE, SAN FRANCISCO, JULY 26 - AUGUST 1, 1970. PREPRINT, 4 P.

ECONOMIC DIFFICULTIES IN SOLVING THE PROBLEM OF CONSERVATION OF WATER SOURCES FROM POLLUTION BECOME ESPECIALLY EVIDENT IF ONE TAKES INTO ACCOUNT THE EVER INCREASING QUANTITIES OF SEWAGE WATERS TO BE DISCHARGED IN THE FUTURE, AND ALSO THE HIGH CONSTRUCTION COSTS OF TREATMENT WORKS (AVERAGING 100 ROUBLES PER CUM. OF WASTES DISCHARGED PER DAY), REQUIRED TO TREAT THESE INCREASED DISCHARGES. HENCE IT FOLLOWS HOW IMPORTANT IT IS TO SEARCH FOR WAYS OF DECREASING CONSTRUCTION AND MAINTENANCE COSTS FOR DECONTAMINATION OF SEWAGE WATERS. THE RELATIONSHIP BETWEEN CONSTRUCTION COSTS OF WORKS FOR TREATING THE SEWAGE WATERS TO DIFFERENT DEGREES OF PU-

RITY IS KNOWN. THIS RELATIONSHIP CAN BE GENERALLY EXPRESSED AS A FUNCTION OF INITIAL AND FINAL CONCENTRATIONS OF A POLLUTANT AND SEWAGE DISCHARGE. AFTER DETERMINING THE REQUIRED CONCENTRATION OF A CERTAIN MATTER CONTAINED IN SEWAGE EFFLUENTS DISCHARGED INTO A WATER STREAM BY EACH PROJECT ON CONDITION OF PROVIDING THE CRITICAL, ADMISSABLE CONCENTRATION OF THIS MATTER AT A DOWNSTREAM WATER USE SITE WITH MINIMUM EXPENSES FOR CONSTRUCTION OF TREATMENT WORKS THE REQUIRED COST OF EACH PROJECT CAN BE EVALUATED THROUGH AN OPTIMIZATION TECHNIQUE. (W70-09750).

00401. DEWATERING SEWAGE SLUDGE BY ELECTROOSMOSIS.

GREYSON, J., ROGERS, H.H.
FIFTH INTERNATIONAL WATER POLLUTION RESEARCH CONFERENCE, SAN FRANCISCO, JULY 26-AUGUST 1, 1970. PREPRINT, 14 P.

ELECTROOSMOTIC PUMPING DERIVES FROM THE ELECTROKINETIC PHENOMENON OF ELECTROOSMOSIS, I. E., THE FLOW OF WATER THROUGH POROUS MATRICES OR CONSTRAINED SUSPENSIONS OF FINE PARTICLES THAT IS ASSOCIATED WITH ION FLOW PRODUCED BY AN APPLIED ELECTRIC FIELD. IN CONTRAST TO CONVENTIONAL FILTRATION, ELECTROOSMOTIC PUMPING IS INDEPENDENT OF THE CROSS-SECTIONAL AREA OF THE PORE STRUCTURE OF THE FILTERING MEDIA AND THE INHERENT LIMITATIONS OF CONVENTIONAL FILTRATION RESULTING FROM PORE CLOGGING OR FILTER CAKE COMPRESSION ARE REMOVED. AN INVESTIGATION OF ELECTROOSMOTIC PUMPING FOR DEWATERING SEWAGE SLUDGES TO A SOLIDS LEVEL SUFFICIENT FOR AUTO-INCINERATION HAS BEEN CARRIED OUT, AND IT HAS BEEN DETERMINED THAT THE TECHNIQUE IS APPLICABLE TO SLUDGES OF VARIOUS TYPES. THE MOST EFFICIENT DEWATERING IS OBTAINED WHEN SOLIDS ARE COLLECTED FROM A SCREEN CATHODE. FOR EFFICIENT DEWATERING FROM VERY WET SLUDGE (2%) TO BURNABLE SOLIDS, IT IS NECESSARY THAT AN INITIAL SLUDGE FILM BE FORMED AT THE CATHODE SURFACE. SLUDGES CANNOT BE THICKENED TO A SOLIDS CONTENT EXCEEDING 20% IF THE CAKE IS BENEATH THE LIQUID LEVEL OF THE SLUDGE SUSPENSION; FOR DRYING BEYOND THE 20% VALUE, THE CAKE MUST BE BROUGHT OUT OF THE LIQUID. PRELIMINARY COST ESTIMATES INDICATE THAT ELECTROOSMOTIC SLUDGE DEWATERING IS A POTENTIALLY ATTRACTIVE UNIT PROCESS. (W70-09752).

00402. GENESEE COUNTY, MICHIGAN, PUBLIC WORKS PLAN FOR WATER POLLUTION CONTROL.

ENGINEERING REPORT TO GENESEE COUNTY DRAIN COMMISSIONER, FLINT, MICHIGAN, JANUARY 1970, 104 P.

A COUNTY-WIDE PUBLIC WORKS PLAN IS DESCRIBED FOR WATER POLLUTION CONTROL IN GENESEE COUNTY, MICHIGAN. THE PLAN FOR SEWERS AND SEWAGE TREATMENT WAS INITIATED BY THE COUNTY DRAIN COMMISSIONER IN ANTICIPATION OF POTENTIAL PROBLEMS FROM EXPANSION OF SERVICE AREAS, RELIEF SEWER REQUIREMENTS, FLOWS FROM OUTSIDE GENESEE COUNTY, AND OVERLOADS ON PRESENT WASTE WATER TREATMENT FACILITIES. THE PURPOSE OF THE PLAN IS TO PROVIDE A SANITARY SEWERAGE SYSTEM DESIGNED TO HANDLE ULTIMATE NEEDS WHEN THE COUNTY AND CONTIGUOUS TRIBUTARY AREA ATTAIN FULL DEVELOPMENT. ALL EXISTING SEWER SYSTEMS AND FUTURE CONSTRUCTION WOULD ULTIMATELY BE MERGED INTO AN INTEGRATED SYSTEM. AT PRESENT, THE CITY OF FLINT PROVIDES WASTE WATER TREATMENT FOR COUNTY FLOWS FROM ONE OF SIX COUNTY SEWAGE DISPOSAL DISTRICTS. TWO ALTERNATIVE PLANS ARE PRESENTED FOR SEWAGE DISPOSAL. ONE IS TO CONTINUE THE AGREEMENT WITH FLINT AND PARTICIPATE IN PLANT EXPANSION. THE OTHER IS TO EXPAND THE CAPACITY OF A COUNTY TREATMENT PLANT AND CONSTRUCT THE TRUNK SEWER NECESSARY FOR FLOW DIVERSION. DESCRIPTIONS OF RECOMMENDED IMPROVEMENTS, EXPANSION AND ADDITIONS TO THE SEWER SYSTEMS AND WASTE WATER TREATMENT FACILITIES, TOGETHER WITH ESTIMATES OF CONSTRUCTION COSTS AND OPERATING COSTS, ARE INCLUDED. METHODS OF FINANCING ARE DISCUSSED. (W70-09796).

00403. REPORT TO THE CITY OF FLINT, MICHIGAN, ON SANITARY AND STORM SEWER SYSTEMS.

REPORT TO DEPARTMENT OF PUBLIC WORKS AND UTILITIES, CITY OF FLINT, MICHIGAN, SEPTEMBER 12, 1969. 159 P.

THE REPORT DESCRIBES THE STUDY PROCEDURES AND PRESENTS THE FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS OF AN ENGINEERING INVESTIGATION OF THE ADEQUACY OF THE SANITARY SEWER AND STORM SEWER SYSTEMS AND THE WASTE WATER DISPOSAL FACILITIES OF THE CITY OF FLINT. THE SEWER SYSTEMS PERFORMED THEIR PRESENT FUNCTIONS SATISFACTORILY; HOWEVER, MAJOR PROBLEMS WERE: (1) BASEMENT FLOODING, (2) RIVER POLLUTION, AND (3) POTENTIAL FLOODING FROM FUTURE STORMWATER DISCHARGES FROM ADJOINING TOWNSHIPS. IN ADDITION TO RECOMMENDATIONS FOR SYSTEM IMPROVEMENTS AND EXPANSION OF EXISTING FACILITIES, SEVERAL FAR-REACHING AND UNCONVENTIONAL RECOMMENDATIONS WERE MADE. ONE OF THESE IS TO SEPARATE THE DOWNTOWN COMBINED-SEWER SYSTEM BY CONSTRUCTING A NEW STORM SEWER SYSTEM IN THIS AREA AND CONVERTING THE EXISTING COMBINED-SEWER TO A SEPARATE SANITARY SEWER. THIS CONSTRUCTION, ESTIMATED TO COST $2 MILLION, SHOULD BE EFFECTIVE IN REDUCING RIVER POLLUTION AND BASEMENT FLOODING FROM OVERFLOWS OF THE PRESENT COMBINED-SEWER. ANOTHER RECOMMENDATION IS TO REMOVE ALL CONNECTIONS TO SANITARY SEWERS FROM ROOF DRAINS, FOUNDATION DRAINS, AND PARKING LOTS. THE CITY SHOULD ENACT LEGISLATION TO PROHIBIT FUTURE CONNECTIONS TO THE SANITARY SEWER SYSTEM FROM FOUNDATION DRAINS OR OTHER SOURCES OF SURFACE WATER OR GROUNDWATER. SPECIAL FIELD INVESTIGATIONS OF SURFACE AND GROUNDWATER INFILTRATION INTO EXISTING SEWERS ARE ALSO RECOMMENDED. A $30,644,000 CONSTRUCTION AND IMPROVEMENT PROGRAM IS PROPOSED. THE NEED FOR COOPERATION BETWEEN FLINT AND GENESEE COUNTY IS STRESSED, PARTICULARLY FOR RAINFALL AND RUNOFF DATA COLLECTION AND FLOOD PLAIN CONSERVATION. (W70-09797).

00404. POLLUTION AND FLOOD CONTROL, A PROGRAM FOR CHICAGOLAND.

REPORT TO METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CHICAGO, ILLINOIS, FEBRUARY 1968. 39 P.

A GENERAL DESCRIPTION IS PRESENTED OF AN INNOVATIVE PROGRAM FOR CONTROL OF WATER POLLUTION AND FLOODING IN THE SERVICE AREA OF THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO. THE REPORT DESCRIBES THE OBJECTIVES, FUNCTIONS, OPERATION AND CHARACTERISTICS OF THE

PROPOSED SYSTEM, CONSTRUCTION TIME SCHEDULES, AND ESTIMATED CONSTRUCTION COSTS. THE PLANS PROVIDE FOR THE CONSTRUCTION OF VERTICAL SHAFTS TO CONVEY OVERFLOWS FROM EACH OF THE 400 OVERFLOW POINTS OF THE EXISTING COMBINED SEWERS, TO HIGH VELOCITY CONVEYANCE TUNNELS EXCAVATED IN ROCK SEVERAL HUNDRED FEET BENEATH THE GROUND SURFACE. THE OVERFLOWS WOULD BE STORED TEMPORARILY IN A HUGE RESERVOIR TO BE EXCAVATED IN ROCK 850 FEET BELOW LAKE CALUMET. UPON CESSATION OF OVERFLOW AND DURING OFF-PEAK HOURS, THE STORED WATER WOULD BE PUMPED TO A SURFACE RESERVOIR AND THEN TO A TREATMENT PLANT FOR TREATMENT PRIOR TO DISCHARGE TO THE WATERWAY. THE $1,270,000,000 PROJECT IS PROPOSED TO BE CONSTRUCTED IN 5 CONSTRUCTION ZONES WITHIN A 300 SQUARE MILE AREA DURING A 10-YEAR PERIOD. THE FIRST ZONE WOULD BE COMPLETED BY EARLY 1973 IF CONSTRUCTION IS BEGUN IN EARLY 1970. HYDROELECTRIC POWER GENERATION IS PROPOSED AS A PART OF THE SYSTEM OPERATION. COST COMPARISONS WITH THREE ALTERNATIVE SOLUTIONS ARE GIVEN. THE ENGINEERS ESTIMATE THAT THE PROPOSED SYSTEM CAN BE COMPLETED TO MEET WATER QUALITY STANDARDS OF THE STATE OF ILLINOIS BY THE 1977 TIME LIMIT. (W70-09799).

00405. PRETREATMENT OF SEWAGE SLUDGE.

BOEHNKE, B.

FOURTH INTERNATIONAL CONGRESS OF THE INTERNATIONAL RESEARCH GROUP ON REFUSE DISPOSAL, PROCEEDINGS, BOSEL, JUNE 2-5, 1969. N.P., N.D., P 615 - 631.

A SUMMARY OF THE MEETINGS AND DISCUSSIONS OF THE WORKING GROUP 5 OF THE 4TH INTERNATIONAL CONGRESS OF THE IRGR IS PRESENTED. THE THEME IS DISCUSSED UNDER EIGHT SECTIONS, NAMELY, (1) CRITERIA FOR THE DEGREE OF AEROBIC AND ANAEROBIC SLUDGE STABILIZATION, (2) OPERATIONAL EXPERIENCE AND COST OF THE FOLLOWING: (A) AEROBIC AND ANAEROBIC SLUDGE STABILIZATION, (B) SLUDGE THICKENING, (C) CENTRIFUGATION WHILE CONSIDERING PRE-CONDITIONING, (D) SLUDGE PROCESSING IN DRYING BEDS AND SLUDGE LAGOONS, (E) VACUUM FILTRATION WHILE CONSIDERING PRE-CONDITIONING, (F) PRESSURE FILTRATION WHILE CONSIDERING PRECONDITIONING, AND (G) SLUDGE DEWATERING THROUGH CONVEYOR SCREEN PRESSER. BASED ON THE ABOVE STUDIES, IT IS CONCLUDED THAT THERE IS NO IDEAL PROCESS FOR SLUDGE TREATMENT BUT AN ADEQUATE SOLUTION CAN BE FOUND FOR EVERY PARTICULAR CASE. THE CHOICE OF TREATMENT DEPENDS ON THE SEWAGE PLANT AND PARTLY ON THE POSSIBILITIES AVAILABLE FOR FINAL SLUDGE DISPOSAL. THE CHOICE OF THE PROCESS DEPENDS ALSO ON THE OBJECTIVE ASSIGNED TO THE PARTICULAR TREATMENT STAGE. COST FIGURES ARE GIVEN FOR SOME OF THE PROCESSES. SINCE IT IS DIFFICULT TO SAY WITH CERTAINTY THE MOST ECONOMICAL COMBINATION OF TWO OR MORE PROCESSES, IT IS ADVISABLE TO MAKE TESTS. MUCH PROGRESS HAS BEEN MADE IN THE DIFFERENT PROCESSES MAINLY DUE TO HIGH MOLECULAR WEIGHT FLOCCULANTS. (W70-09811).

00406. INORGANIC CHEMICAL INDUSTRY: CLEAN WATER COST ESTIMATE.

ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 14(6), P 469-470, 1970.

'ECONOMICS OF CLEAN WATER' THE THIRD ANNUAL REPORT TO CONGRESS ON THE COST OF CLEAN WATER FOR THE UNITED STATES CONTAINS WASTE WATER TREATMENT PROFILES FOR MUNICIPALITIES ANIMAL FEED LOT WASTES, AND INORGANIC CHEMICALS INDUSTRY. THIS REPORT DETAILS THE IN-DEPTH COST ESTIMATES ACHIEVING CERTAIN LEVELS OF WASTE WATER TREATMENT WITHIN THESE PARTICULARLY TROUBLED AREAS. DURING THE 5 YEAR PERIOD FROM 1970 TO 1974 THE INORGANIC CHEMICALS INDUSTRY WILL HAVE TO INCREASE OUTLAYS NEARLY 8 FOLD TO REACH THE 100% LEVEL OF TREATMENT. TO KEEP ITS PRESENT LEVEL OF TREATMENT THE INDUSTRY MUST INCREASE PRESENT OUTLAYS FOR CAPITAL AND OPERATING EXPENSES MORE THAN 50% FROM 414.5 MILLION IN 1970 TO 630.2 MILLION IN 1974. THE MAIN PROBLEM WITH THE TREATMENT OF INDUSTRY'S WASTES IS THE SOLIDS, BOTH DISSOLVED AND SUSPENDED. IN GENERAL BIOLOGICAL METHODS OF TREATMENT ARE NOT APPLICABLE FOR PHYSICAL TREATMENT OF EQUALIZATION, NEUTRALIZATION, FLOCCULATION, SEDIMENTATION, AND SLUDGE DEWATERING ARE EMPLOYED. THE COST ESTIMATES FOR TREATMENT WERE DEVELOPED FOR 4 LEVELS OF FLOW RATES, 3 LEVELS OF ACIDITY, 2 LEVELS OF SUSPENDED SOLIDS AND 3 LEVELS OF TOTAL DISSOLVED SOLIDS. HOWEVER, THE DATA FROM THE 59 PLANTS, REPRESENTATIVE OF THE 2,700 PLANTS IN THE UNITED STATES, WERE NOT SUFFICIENTLY COMPLETE WITH REGARD TO EFFLUENT QUALITY TO CONSTRUCT A STATICALLY SIGNIFICANT RELATIONSHIP BETWEEN THE NUMBERS OF PLANTS AND THE EFFLUENT QUALITY PARAMETERS SUCH AS ACIDITY, SUSPENDED SOLIDS, AND DISSOLVED SOLIDS. (W71-00119).

00407. HIGH-RATE, FINE-MESH SCREENING OF COMBINED WASTE WATER OVERFLOWS.

MARSKE, D.M.

WATER POLLUTION CONTROL FED J, 42(8), 1476-1494, 1970.

MOST COMBINED SEWERS DO NOT HAVE A CAPACITY DURING HEAVY STORM PERIODS TO TRANSPORT ALL OF THE WASTE AND STORM WATER TO A TREATMENT FACILITY. THIS PAPER REPORTS ON (1) THE CHARACTER OF THE COMBINED WASTE WATER OVERFLOWS, (2) THE TREATMENT CAPABILITY OF HIGH-RATE, FINE-MESH SCREENS, AND (3) COMPARISON OF HIGH-RATE, FINE-MESH SCREENING TO OTHER METHODS OF TREATING COMBINED WASTE WATER OVERFLOWS. THE SCREEN UNIT PRODUCED THE BEST RESULTS WHEN OPERATED AT AN INFLUENT FLOW RATE OF 1,700 GPM (130 GPM/SQ FT) WITH A 165 MESH STAINLESS STEEL COLLAR SCREEN ROTATING AT A SPEED OF 60 RPM. THE SCREEN UNIT IS CAPABLE OF TREATING COMPARABLE TO A PRIMARY CLARIFIER. THE SCREENED EFFLUENT FLOW IS TYPICALLY 90% OF THE INFLUENT. THE SCREENING UNIT IS AN ECONOMICALLY FEASIBLE METHOD OF TREATING COMBINED WASTE WATER OVERFLOWS. FACTORS TO BE CONSIDERED IN THE SELECTION OF SCREENING ARE DISCUSSED. THE ESTIMATED CONSTRUCTION COSTS FOR A 25 MGD SCREENING FACILITY IS $496,000. THE ESTIMATED ANNUAL MAINTAINANCE COST IS $18,500. THE COST OF TREATMENT IS ESTIMATED AT $0.22/1000 GAL. (W71-00127).

00408. PERFORMANCE OF THE SOMERSET, OHIO, OXIDATION DITCH.

KANESHIGE, H.M.

JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 42(7), 1370-1378, 1970.

A THREE YEAR STUDY OF THE OPERATION OF A MECHANICALLY AERATED OXIDATION DITCH WITH FINAL SETTLING AND SLUDGE RETURN WAS CONDUCTED AT SOMERSET, OHIO. THE PLANT SERVING ABOUT 1,500 PEOPLE AND TREATING PREDOMINANTLY DOMESTIC WASTE ACHIEVED EXCELLENT OVERALL REMOVAL OF SUSPENDED SOLIDS AND BOD. POWER CONSUMPTION WAS ABOUT 1 KWH/CU M OR 4 TO 5 KWH/KG BOD REMOVED. POWER COSTS WERE ABOUT $20/1000 CU M OF FLOW COM-

PARED WITH ABOUT $28/1000 CU M FOR EXTENDED AERATION PLANTS. SURGES AND MECHANICAL PROBLEMS CAUSED REDUCTION IN EFFLUENT QUALITY BUT THE PLANT RECOVERED QUICKLY. EXTREMELY COLD WEATHER ALSO CAUSED POOR PERFORMANCE. EXTENSIVE VELOCITY DISTRIBUTIONS STUDIES WERE MADE AND SEVERAL FIGURES ARE PRESENTED ILLUSTRATING THE RESULTS. MONTHLY AVERAGES FOR BOD RANGED FROM 150 TO 300 MG/L AVERAGING BETWEEN 225 AND 275 MG/L. FINAL EFFLUENT BOD RANGED FROM 4 TO 196 MG/L AVERAGED AROUND 8 TO 10 MG/L. (W71-00130).

00409. CANNERY WASTE WATER TREATMENT BY HIGH-RATE SPRAY ON GRASSLAND.

LAW, J.P. JR; THOMAS, R.E.; MYERS, L.H.
JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 42(9), 1681-1631, 1970.

A 12-MONTH SURVEY WAS CONDUCTED TO DETERMINE THE TREATMENT AND EFFICIENCY OF A SPRAY-RUNOFF SYSTEM FOR CANNERY WASTES. A TOTAL OF 133 INCHES OF WASTE WATER WAS APPLIED TO EACH OF 4 EXPERIMENTAL AREAS. HYDROLOGICAL MEASUREMENTS, MASS RMOVAL EFFICIENCIES AND SOIL WATER QUALITY WERE EVALUATED IN RELATION TO AGE OF THE SYSTEM, SOIL TYPE AND SPRAY SCHEDULING. HYDROLOGICAL MEASUREMENTS SHOWED THAT 18% OF THE APPLIED WATER WAS LOST THROUGH EVAPORATIVE PROCESS, 61% RETURNED TO SURFACE DRAINS AS RUNOFF AND THE REMAINING 21% PERCOLATED THROUGH THE SOIL. A NORMAL ONCE-A-DAY SPRAY SCHEDULE RESULTED IN 92% TO 99% REMOVAL OF THE VOLATILE SOLIDS AND OXYGEN DEMANDING ORGANICS, 83 TO 90% REMOVAL OF TOTAL NITROGEN AND 50% TO 60% REMOVAL OF THE TOTAL PHOSPHORUS. THE ESTIMATED CAPITAL COST OF INSTALLING SUCH A SPRAY RUNOFF SYSTEM IS APPROXIMATELY $1,000 PER ACRE. THE SYSTEM IS DESIGNED TO HANDLE UP TO 3.6 MGD ON APPROXIMATELY 500 ACRES. OPERATING COSTS WERE ESTIMATED AT $0.05/1000 GAL OF WASTE WATER TREATED. (W71-00134).

00410. CHEMICAL CONTROL OF TREE ROOTS IN SEWER LINES.

AHRENS, J.F.; LEONARD, O.A.; TOWNLEY, N.R.
JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, VOL 42(9), 1643-1655, 197.

STUDIES WERE MADE OF HEBICIDES THAT WOULD SELECTIVELY KILL TREE ROOTS IN SEWER LINES BY THE FLOOD TECHNIQUE. TOXICITY OF HERBICIDES TO ROOTS AND INJURY TO FOLIAGE FROM ROOT UPTAKE WAS STUDIED IN WOODY CONTAINER GROWN PLANTS FIRST TO SCREEN HERBICIDES AND THEN TO DETERMINE THE FACTORS EFFECTING TOXICITY IN MOVEMENT OF METHAM AND DICHLOBENIL. THE LATTER TWO WERE ALSO TESTED IN SANITARY SEWERS. SOLUTIONS OF DICHLOBENIL AT 100 MG/L KILLED ALL THE ROOTS EXCEPT THOSE OF PEACH EXPOSED FOR 10 TO 60 MINUTES. SOLUTIONS OF METHAM AT 5000 MG/L KILLED MOST ROOTS EXPOSED FOR 1 MINUTE OR MORE. IN SANITARY SEWERS IN SACRAMENTO A ONE-HOUR FLOOD TREATMENT WITH METHAM, DICHLOBENIL AND COMBINATIONS OF THE TWO KILLED ALL ROOTS IN THE LINE AND MOST OF THE ROOTS IN JOINTS INSPECTED. METHAM ALSO KILLED ROOTS EXTENDING A SHORT DISTANCE OUTSIDE JOINTS. THE INITIAL COST OF CHEMICAL FLOODING AND MECHANICAL ROOT REMOVAL WERE ABOUT THE SAME, BUT CHEMICAL FLOODING IS EXPECTED TO REDUCE THE COST OF FURTHER SEWER MAINTENANCE OPERATIONS. THE AVERAGE COST OF POWER ROOTING 50 MILES OF SEWER LINES WAS $0.11/FT INCLUDING ALL LABOR, EQUIPMENT AND OVERHEAD. THE FLOOD METHOD DESCRIBED IN THIS PAPER WAS TESTED ON 20,000 FEET OF 6 INCH LINE. IT COST $0.063/FT FOR CHEMICALS AND $0.053/FT FOR ALL LABOR, EQUIPMENT AND OVERHEAD. THEREFORE, A COMPARABLE COST OF $0.113/FT WAS DETERMINED. (W71-00137).

00411. PRELIMINARY REPORT ON GEOHYDROLOGIC EXPLORATION FOR DEEP WELL DISPOSAL OF EFFLUENT.

LUM, D.
HAWAII DEPARTMENT OF THE LAND AND NATURAL RESOURCES, CIRCULAR C 54, 14 P.

BECAUSE OF A HIGH ESTIMATED COST OF CONSTRUCTING AN OCEAN OUTFALL SEWAGE EFFLUENT DISPOSAL SYSTEM, THE HAWAIIAN DEPARTMENT OF LAND AND NATURAL RESOURCES DECIDED TO INVESTIGATE EFFLUENT DISPOSAL UTILIZING DEEP WELLS. THE VARIOUS GEOHYDROLOGIC INVESTIGATIONS WERE COMPLETED OVER A THREE-YEAR PERIOD IN THREE PHASES. FIRST, A PRELIMINARY INJECTION TEST UTILIZING AN EXISTING NON-USED WELL. SECOND, SUBSURFACE GEOHYDROLOGIC EXPLORATION CONSISTING OF DRILLING, CORING, AND TESTING EIGHT NX-SIZE TEST HOLES. DEPTHS VARIED FROM 50 TO 450 FEET AND A TOTAL OF 2,200 FEET OF CORE DRILLING AND HYDROLOGIC TESTING WERE ACCOMPLISHED. THIRD, DRILLING AND TESTING OF THREE-15 INCH DIAMETER DISPOSAL WELLS WITHIN THE SEWAGE TREATEMENT PLANT SITE. TEST RESULTS SHOW THAT THE THREE 15-INCH DISPOSAL WELLS HAVE A MINIMUM CAPACITY OF 34.0 MGD (MILLION GALLONS PER DAY), COMPARED TO THE PRESENT 1.1 MGD AND THE ULTIMATE 2.2 MGD EFFLUENT FLOW DESIGNED FOR THE WAIMANALO SEWAGE TREATMENT PLANT. ALSO, THE 14.0 MGD CAPACITY OF THE WELLS IS TWICE THE 7.0 MGD DESIGN PEAK FLOW OF THE TREATMENT PLANT. (W71-00430).

00412. ENGINEERING INVESTIGATION OF SEWER OVERFLOW PROBLEM - ROANOKE, VIRGINIA.

SNAPP, W.R.; LEMON, R.A.
WATER POLLUTION CONTROL RESEARCH SERIES--11024 DMS 05/70, MAY 1970, 250 P.

RESULTS ARE GIVEN OF INVESTIGATIONS, ON 25 PERCENT OF ROANOKE, VIRGINIA'S SEPARATE SANITARY SEWERAGE SYSTEM, ON THE AMOUNTS OF INFILTRATION FOR VARIOUS STORM INTENSITIES AND DURATIONS AND THE AMOUNTS OF SEWAGE OVERFLOW FROM THE SYSTEM. FROM THESE RESULTS THE SYSTEM WAS ANALYZED, USING AN IN-HOUSE DEVELOPED COMPUTER PROGRAM, TO ASSESS THE MAGNITUDES AND FREQUENCIES OF OVERFLOWS. THE GENERATED DATA FROM THE ANALYSIS WERE USED TO DEVELOP AN OPTIMUM DESIGN FOR REMEDIAL MEASURES TO REDUCE SEWER OVERFLOWS. COST ESTIMATES ARE PRESENTED FOR THE VARIOUS ITEMS OF WORK INVOLVED. (PB-195 201) (W71-00478).

00413. POLLUTION, PURIFICATION AND THE THEORY OF EXTERNAL EFFECTS.

BOHM, P.
SWEDISH JOURNAL OF ECONOMICS, 72(2), 153-166, 1970.

THIS PAPER DISCUSSES THE CHOICE BETWEEN TAXATION AND CENTRALIZED PURIFICATION AS A MEANS OF REGULATING POLLUTION. EXTERNAL EFFECTS THEORY, INDICATES THAT EFFICIENT RESOURCE ALLOCATION IS OBTAINED BY IMPOSING A TAX ON POLLUTERS EQUAL TO THE VALUE OF THE MARGINAL EXTERNAL EFFECTS. THIS SOLUTION RESULTS IN AN OPTIMAL LEVEL OF POLLUTION

BUT DOESN'T YIELD POSITIVE NET BENEFITS. THE TAX APPROACH MAY NOT BE VALID WHEN THE CENTRAL PURIFICATION ALTERNATIVE IS FEASIBLE. WHEN NEGATIVE MARGINAL EXTERNAL EFFECTS ARE PRESENT, THE CENTRAL PURIFICATION SOLUTION IS SUPERIOR TO TAXATION AS LONG AS THE NET BENEFITS FROM PURIFICATION ARE GREATER THAN THOSE FROM TAXATION, AND MOREOVER THE OPTIMAL MARGINAL COST PRICE FOR PURIFICATION IS BELOW OR ABOVE THE TAX AND THE EXTERNAL EFFECTS ARE INCREASING OR DECREASING. HOWEVER, THE PURIFICATION SCHEME IS NOT PREFERABLE TO THE ABOVE TAX SCHEME IN THE CASE OF A DECREASING COST INDUSTRY OR WHEN THERE ARE INCREASING NEGATIVE MARGINAL EXTERNAL EFFECTS. THIS ARTICLE IS OF PRACTICAL IMPORTANCE IN PROVIDING THEORETICAL GUIDELINES FOR POLICY MEASURES TO REDUCE POLLUTION. (W71-00752).

00414. MICROSTRAINING AND DISINFECTION OF COMBINED SEWER OVERFLOWS.

GLOVER, G.E.; YATSUK, P.M.
WATER POLLUTION CONTROL RESEARCH SERIES 11023 EVO 06/70, JUNE 30, 1970.75 P.

MICROSTRAINING (C) COPYRIGHTED TRADE NAME-CRANE CO., GLENFIELD AND KENNEDY DIV., USING A MICROSTRAINER SCREEN OF A NOMINAL APERTURE OF 23 MICRONS, REMOVED UP TO 98% OF THE SUSPENDED SOLIDS FROM A COMBINED SEWER OVERFLOW. THE SEWER, IN A RESIDENTIAL AREA OF PHILADELPHIA, HAS AN AVERAGE DWF OF 1,000 GPH. THE MAXIMUM COMBINED SEWER FLOW DURING RAINSTORMS IN ONE YEAR OF OPERATION WAS 304,000 GPH (11.3 CFS). VOLATILE SUSPENDED SOLIDS REMOVALS WITH THE ABOVE SCREEN HAVE AVERAGED 68% AND 71% DURING DIFFERENT TEST PERIODS. RESULTS INDICATED THAT THERE WAS A SLIGHTLY BETTER KILL OF COLIFORM GROUP BACTERIA WITH CHLORINE THAN WITH OZONE IN THE MICROSTRAINER EFFLUENTS WHEN BOTH WERE USED AT AN INITIAL NOMINAL CONCENTRATION OF 5 PPM, WITH 5 TO 12 MINUTES DETENTION TIME. HOWEVER, CHLORINE WAS APPLIED AT SLIGHTLY HIGHER LEVELS AND WITH BETTER CONTROL THAN OZONE. PRELIMINARY ESTIMATES OF THE COSTS OF TREATMENT VIA MICROSTRAINING, USING TENTATIVELY-ESTABLISHED THROUGHPUT RATES, SHOW THAT THE CAPITAL COSTS PER ACRE OF DRAINAGE WOULD BE APPROXIMATELY $10,200 FOR MICROSTRAINING ALONG, $11,200 FOR MICROSTRAINING PLUS CHLORINATION, AND $19,800 FOR MICROSTRAINING PLUS OZONATION. OF EIGHT OTHER CURRENTLY-PROPOSED SCHEMES, WHOSE COSTS WERE ESTIMATED, ONLY SURFACE IMPOUNDMENT (WHERE AESTHETICALLY ACCEPTABLE AND WHERE LOW COST LAND IS AVAILABLE) APPEARS COMPETITIVE. (PB-195 674) (W71-01263).

00415. ENGINEERING REPORT ON COUNTY-WIDE WASTE WATER INTERCEPTING AND TREATMENT FACILITIES.

DUPAGE COUNTY DEPARTMENT OF PUBLIC WORKS, WHEATON, ILLINOIS, JULY 1968.133 P.

A COMPREHENSIVE STUDY WAS MADE OF TWO POSSIBLE SYSTEMS. ONE SYSTEM WOULD INCLUDE A NETWORK OF INTERCEPTING SEWERS THROUGHOUT DUPAGE COUNTY TO COLLECT ALL WASTE WATERS FROM LOCAL SEWER SYSTEMS FOR CONVEYANCE TO A LARGE SINGLE WASTE WATER TREATMENT PLANT. THE OTHER SYSTEM WOULD CONSIST OF NINE SEPARATE WASTE WATER TREATMENT PLANTS DISTRIBUTED THROUGHOUT THE COUNTY AND A NETWORK OF INTERCEPTING SEWER SYSTEMS. THE SINGLE PLANT SYSTEM WAS RECOMMENDED BY THE ENGINEERS, PRIMARILY BECAUSE OF THE ECONOMIES OF SCALE. IT WOULD REPLACE 80 PLANTS PRESENTLY TREATING ABOUT 50 MGD AND SERVING 325,000 PERSONS. THE SYSTEM, PROPOSED FOR 67 MGD INITIALLY, WOULD COST ABOUT $119 MILLION COMPARED TO ONLY $110 MILLION FOR THE MULTI-PLANT DESIGN; HOWEVER, THE TOTAL ESTIMATED OPERATING COST FOR A 15-YEAR PERIOD (1970-1985) WOULD BE LESS -- $29.9 MILLION COMPARED TO $43.6 MILLION. THE COUNTY'S SHARE OF THE COST IS PROPOSED TO BE FINANCED THROUGH BOTH REVENUE BONDS AND GENERAL OBLIGATION BONDS. STATE AND FEDERAL AID IS SUGGESTED. THE PROPOSED SYSTEM WOULD UTILIZE ACTIVATED SLUDGE TREATMENT, TERTIARY TREATMENT, AND, POSSIBLY, FILTRATION AND CHLORINATION. REUSE IS DISCUSSED OF TREATED WASTE WATER AS POTABLE WATER, ALTHOUGH THE PROPOSED FACILITIES DO NOT CONTEMPLATE THIS FEATURE INITIALLY. THE ADDITIONAL FACILITY COSTS WOULD BE APPROXIMATELY $38.6 MILLION, AND 1985 ANNUAL OPERATING AND MAINTENANCE COSTS ARE ESTIMATED AT $2.4 MILLION, OR $0.22.6/1,000 GAL. (W71-01337).

00416. INSTREAM AERATORS FOR POLLUTED RIVERS.

WHIPPLE, W.; COUGHLAN, F.P.; YU, S.L.
JOURNAL OF SANITARY ENGINEERING DIVISION, ASCE, 96(SA5), PROC.PAPER 7631, OCT. 1970, P. 1153-1165.

FIELD TESTS AND PERFORMANCE ANALYSIS OF INSTREAM AERATION EQUIPMENT ON THE PASSAIC RIVER SHOWED MECHANICAL AERATORS WERE MORE EFFICIENT THAN DIFFUSERS. COST ESTIMATES INDICATE THAT NINE 75-HP MECHANICAL AERATORS WITH A TOTAL RATED CAPACITY OF 675 HP WOULD HAVE TOTAL ANNUAL COSTS OF $102,000 OR $151 PER ANNUAL HP OF RATED CAPACITY. ELECTRIC-DRIVE DIFFUSER AERATORS RATED AT 80 HP EACH WOULD HAVE TOTAL ANNUAL COSTS OF $141,400 OR $147 PER ANNUAL HP OF RATED CAPACITY. A SYSTEMS ANALYSIS, BASED UPON THE PRINCIPLE OF BOD MASS BALANCE ANALYSIS, SHOWED THAT AERATORS WOULD ACHIEVE A GIVEN DISSOLVED OXYGEN LEVEL AT ABOUT ONE-FOURTH THE COST OF ADVANCED WASTE TREATMENT. APPLICATION SHOULD BE CONSIDERED FOR THOSE STREAMS WHERE SECONDARY WASTE TREATMENT IS NOT SUFFICIENT TO ACHIEVE DISSOLVED OXYGEN LEVELS DESIRED. (W71-01342).

00417. THE COST OF IMPROVING WATER QUALITY IN THE GREAT LAKES.

HENNIGAN, R.D. ,
WATER AND WASTES ENGINEERING, 6(0), A-28-A-31, 1969.

THE TOTAL FIVE YEAR COST FOR WATER QUALITY IMPROVEMENT IS APPROXIMATELY $3.7 BILLION. ABOUT 95% OF THIS IS FOR CONSTRUCTION AND OPERATION OF MUNICIPAL AND INDUSTRIAL WASTE TREATMENT FACILITIES. A 30% FEDERAL, 30% STATE, AND 40% LOCAL SHARE OF TREATMENT FACILITIES COST IS A FAIR ALLOCATION IF NO CEILINGS EXIST ON INDIVIDUAL PROJECTS OF AVAILABLE FUNDS. WHEN THE COST OF SEWER CONSTRUCTION IS INCLUDED, THE ALLOCATION BECOMES 15% FEDERAL, 15% STATE, AND 70% LOCAL BECAUSE SEWER COSTS ARE GENERALLY NOT ELIGIBLE FOR FEDERAL AID. THE FEDERAL GOVERNMENT, STATE AND LOCAL AGENCIES NEED A FOCUS, STAFF, BUDGET, AND INDEPENDENCE TO PROVIDE EXECUTIVE RESPONSIBILITY. IF THE PROPER INSTITUTIONAL ARRANGEMENTS ARE NOT FORTHCOMING, GREAT SUMS OF MONEY WILL BE WASTED AND GOALS NOT REALIZED. (W7-01354

COST ANALYSIS OF WATER POLLUTION CONTROL

00418. MINIMAL COST ESTIMATION FOR LAKEFRONT SEWAGE SYSTEMS.

NORTON, K.W.; FORSTE, R.H.
WATER RESOURCES RESEARCH CENTER, TECHNICAL WORKING PAPER NO. 1, JAN. 1969. 20 P.

THE OBJECTIVES OF THIS PAPER WERE TO ESTIMATE THE MINIMAL COST OF A MUNICIPAL SEWERAGE SYSTEM FOR THE PAWTUCKAWAY LAKE AREA OF NOTTINGHAM, N. H., AND TO DEVELOP A METHOD OF ESTIMATING MINIMAL COST THAT WOULD BE APPLICABLE IN OTHER SIMILAR SITUATIONS. EQUATIONS FOR DETERMINING THE DIAMETER OF THE MAIN SEWER AND THE LENGTH OF REQUIRED SLEEVE PIPE WERE DEVELOPED IN TERMS OF THE PERCENTAGE OF LAND SUITABLE FOR DEVELOPMENT DENSITY OF BACK LOTS. ITEMS WHICH WERE INCLUDED IN THE COST ESTIMATE WERE: A SEWAGE TREATMENT PLANT, PUMPING STATIONS, MANHOLES, MANHOLE COVERS, MAJOR PIPES INCLUDING EXCAVATION AND BACKFILL, AND FOUR INCH SLEEVE PIPES ALSO INCLUDING EXCAVATION AND BACKFILL. THE TOTAL MINIMAL COST OF THESE ITEMS WAS EXPRESSED AS THE SUMMATION OF ALL THE UNIT COSTS TIMES THEIR RESPECTIVE REQUIRED QUANTITIES. ALTHOUGH THE METHOD WAS DEVELOPED FOR THE PAWTUCKAWAY LAKE AREA, A GENERALIZED FORMULA IS GIVEN WHICH MAY BE APPLIED TO ESTIMATE THE MINIMAL COST OF OTHER LAKE-FRONT SEWERAGE SYSTEMS. (PB-195 792) (W71-01410).

00419. ADVANCED WASTEWATER TREATMENT.

GOODMAN, B.L.; MIKKELSON, K.A.
CHEMICAL ENGINEERING, 77(9), 75-83; 1970.

THE COMBINED BIOLOGICAL-CHEMICAL PROCESS OFFERS INHERENT SIMPLICITY, LOW CAPITAL COST AND EASE OF INTEGRATION INTO CONVENTIONAL ACTIVATED SLUDGE PLANTS. FOR EFFICIENCY THE COMBINED PROCESS REQUIRES LOW SLUDGE AGE, PROPER POINT OF CHEMICAL ADDITION AND EFFECTIVE SOLID-LIQUID SEPARATION IN FINAL CLARIFICATION STEP. BASICALLY, SOLUBLE PHOSPHORUS IS CONVERTED TO INSOLUBLE FORM BY COMPLEXING WITH METALLIC IONS COUPLED WITH MICROBIAL PHOSPHORUS ASSIMILATION, AND INCORPORATION OF INSOLUBLE PHOSPHORUS INTO SLUDGE MASS AND ITS REMOVAL FROM THE LIQUID PHASE BY EFFICIENT SOLIDS-LIQUID SEPARATION DEVICE. SYNTHETIC ORGANIC POLYELECTROLYTES ARE UTILIZED FOR PARTICLE AGGLOMERATION AND REMOVAL. MODIFICATION OF CONVENTIONAL CLARIFIER DESIGN TO USE THE CLARIFIER FLOC BLANKET AS A FILTERING DEVICE IMPROVES CLARIFICATION. INCORPORATION OF AUTOMATICALLY-ACTUATED BACKWASH CYCLES, QUALITY MONITORING, PROPER FLOW DISTRIBUTION, EFFICIENT 'CLEANSING' OF THE MEDIA BETWEEN CYCLES, PROPER DESIGN OF SYSTEMS, AND DURATION OF FILTRATION CYCLES ARE IMPORTANT. DUE TO RELATIVELY LOW DOSAGE NEEDED TO ACHIEVE SUBSTANTIAL INCREASE IN SETTLING RATE, WATER SOLUBLE, CATIONIC POLYMERS ARE BEST SUITED, GENERALLY. AFTER AN INITIAL POLYMER TREATMENT, THE DOSAGE WAS REDUCED TO 1/5. EFFLUENT SOLIDS CONCENTRATION THEN FELL TO AN ACCEPTABLE LEVEL, MAINTAINED UNTIL POLYMER ADDITION WAS TERMINATED. FOLLOWING POLYMER TREATMENT, THE BENEFICIAL EFFECT DECAYED WITH TIME. (W71-01480).

00420. ENGINEERING ASPECTS OF NUTRIENT REMOVAL.

ROHLICH, G.A.
EUTROPHICATION; CAUSES, CONSEQUENCES, CORRECTIVES, P 37-382. PRINTING AND PUBLISHING OFFICE, NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D.C., 1969.

ION EXCHANGE FOR NITROGEN REMOVAL IS DISCUSSED. AMMONIA NITROGEN MAY BE REMOVED BY DESORPTION IN A TOWER PACKED WITH RASHIG RINGS. CHEMICAL METHODS HAVE RECEIVED MORE ATTENTION FOR REMOVING PHOSPHORUS THAN NITROGEN. RESULTS OF CHEMICAL TREATMENT OF SEWAGES WITH FERRIC CHLORIDE ARE REPORTED. STUDIES OF AN OPERATING PLANT SHOWED THAT MIXING, FLOCCULATION, AND SETTLING ARE INEFFICIENT. ALUMINUM SULFATE IN THE FORM OF 'FILTER ALUM' IS USED AS A COAGULANT, AND A PROCESS DEVELOPED FOR ITS RECOVERY. LIME, ALUM, AND SODIUM HYDROXIDE HAVE BEEN UTILIZED FOR REMOVAL OF PHOSPHORUS AND NITROGEN COMPOUNDS. BIOLOGICAL METHODS, BY WHICH LIVING ORGANISMS INCORPORATE NUTRIENTS INTO PROTOPLASMIC STRUCTURE, PROCESS FLOW SYSTEMS, STABILIZATION PONDS, AND REMOVAL OF NITROGEN AND PHOSPHATE IN THE ACTIVATED SLUDGE PROCESS ARE EVALUATED. DIVERSION AND IRRIGATION MAY ALSO REDUCE NUTRIENT INPUT TO RECEIVING WATERS. (W71-01499).

00421. EVALUATION OF FACILITY OPERATION (LITERATURE REVIEW).

VOSHEL, D.M.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42(6), 969-971, 1970.

DESCRIPTIONS OF NEW FACILITIES AND IMPROVEMENT OF EXISTING FACILITIES OF SEVERAL TREATMENT PLANTS WERE DESCRIBED. NEW SURFACE AERATORS IN GREECE, NEW YORK, TREATMENT PLANT RESULTED IN MORE EFFICIENT MIXING AND THUS MORE OXYGEN TRANSFER INCREASING OVERALL BOD REMOVAL FROM 70.8% TO 81.7% AND SUSPENDED SOLIDS REMOVAL FROM 76.8% TO 83.9%. THE EXPANDED SECONDARY TREATMENT PLANT AT BELOIT, WISCONSIN, EMPLOYS A UNIQUE SLUDGE PRESS AND OVAL CONCRETE AERATION TANKS PROVIDING A HIGH PERFORMANCE SECOND-STAGE PURIFICATION FACILITY AND A PROVING GROUNDS FOR A NEW CONCEPT IN TREATMENT EQUIPMENT. WELLAND, ONTARIO, COMPLETED AN ULTRA-MODERN POLLUTION CONTROL PLANT WITH AN AVERAGE CAPACITY OF 8 MGD AND PEAK DESIGN FLOW OF 20 MGD. THE COST OF THE TREATMENT FACILITY WAS $2.35 MILLION AND $5.5 MILLION FOR A NEW CONNECTING TRUNK SEWER SYSTEM. THE PRIMARY PLANT WAS DESIGNED TO REMOVE 95% GRIT, 70% SETTLEABLE SOLIDS, AND 30% BOD. THE SLUDGE IS DIGESTED, THICKENED AND VACUUM FILTERED. THE WATER POLLUTION CONTROL PLANTS OF OTHER CITIES WERE DESCRIBED GIVING REMOVAL EFFICIENCIES AND COSTS. (W71-01762).

00422. FOAM SEPARATIONS FOR INDUSTRIAL WASTES: PROCESS SELECTION.

GRIEVES, R.B.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42(8), PART II, R336-R344.

FOAM SEPARATIONS HAVE BEEN SHOWN TO BE FEASIBLE IN A NUMBER OF WASTE TREATMENT APPLICATIONS. TWO PARAMETERS, ONE A CONCENTRATION RATIO AND THE OTHER A QUANTITY RATIO, HAVE BEEN INDICATED TO BE PARTICULARLY USEFUL IN EVALUATING THE EFFECTS ON THE EXTENT OF SEPARATION OF KEY INDEPENDENT VARIABLES. FREQUENTLY THE PROCESS CHOICE MAY BE LEFT TO THE DESIGN ENGINEER. IN THIS CASE HE SHOULD SELECT A PROCESS INVOLVING THE FLOTATION OF COLLOIDAL OR ALREADY PRECIPATED PARTICLES AS OPPOSED TO THE FOAM FRACTIONATION FOR ION FLOTA-

TION OF SOLUBLE SPECIES. A VARIETY OF OPERATIONAL MODIFICATIONS IS AVAILABLE. THE TWO-STAGE PRECIPITATION FLOTATION OF CR (III) HYDROXIDE IS A FEASIBLE PROCESS FOR THE TREATMENT OF CHROMIUM WASTES, WITH AN OPERATING COST OF $0.67/LB CR. AN ADDITIONAL CHOICE TO BE MADE IS THAT BETWEEN DISSOLVED AIR AND DISPERSED AIR FOAM SEPARATION. FOR THE REMOVAL OF SEDIMENTS FROM NATURAL WATERS THE OPERATING COSTS ARE $0.50/1000 GAL FOR DISPERSED AIR AND $0.60/1000 GAL FOR DISSOLVED AIR, PRODUCING EXCELLENT CALCIFICATION OF VERY TURBID WATERS. (W71-01843).

00423. ECONOMIC TRANSPORT OF DIGESTED SLUDGE SLURRIES.

RAYNES, B.C.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42(7), 1379-1386, 1970.

PIPELINE TRANSPORT OF DIGESTED SLUDGE TO DISPOSAL AREAS LOCATED AT CONSIDERABLE DISTANCE FROM THE GENERATING TREATMENT PLANT MAY OFFER THE WASTE WATER PLANT OPERATORS SUBSTANTIAL ECONOMIC BENEFITS. THE COST SAVINGS OF TRANSPORTATION OF THE DIGESTED SLURRY ARE RELATED TO THE DISTANCE, THE QUANTITY, THE SOLIDS CONCENTRATION AND OTHER VARIABLES. THE SLUDGE SLURRIES VARY IN FLOW BEHAVIOR AS A FUNCTION OF SOLIDS CONCENTRATION. AT SOLIDS CONCENTRATIONS ABOVE 5% THEY BEHAVE AS BINGHAM PLASTICS WHILE BELOW 5% THEIR BEHAVIOR IS NEWTONIAN. PIPELINING IN THE NEWTONIAN REGION SHOULD BE THE MOST ECONOMICAL PROCEDURE DESPITE THE INCREASED VOLUME OF MATERIAL TO BE TRANSPORTED. EVEN WHERE DILUTION IS PRACTICED THE QUANTITY OF DIGESTED SLUDGE AVAILABLE FROM MANY WASTE WATER TREATMENT PLANTS DICTATES THE USE OF PIPELINES PERHAPS AS SMALL AS 2 INCHES IN DIAMETER. ANOTHER PURPOSE OF THIS INVESTIGATION IS TO ENCOURAGE THE USE OF DIGESTED SLUDGE SLURRIES IN THE RECLAMATION OF LAND AREAS IN NEED OF REVEGETATIVE ASSISTANCE AND IN PARTICULAR THOSE STRIP MINE AREAS OR SIMILAR LAND AREAS THAT CONSTITUTE WATER POLLUTION PROBLEMS IN THEMSELVES. (W71-01844).

00424. TREATMENT OF FRUIT PROCESSING WASTE BY AERATION.

ESVELT, L.A.; HART, H.H.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42(7), 1305-1326, 1970.

THE WASTE TREATMENT SYSTEM OF A COOPERATIVE FRUIT PROCESSING CANNERY WAS STUDIED FOR TWO OPERATING SEASONS TO DETERMINE TREATMENT EFFICIENCY AND TO ESTABLISH PARAMETERS FOR THE TREATMENT OF LIQUID FRUIT PROCESSING WASTES BY AERATION. THE CANNERY PROCESSES PEARS, PEACHES, APPLES, AND OTHER FRUITS IN A LESSER AMOUNT. THE FACILITIES OPERATE AT A FLOW OF 0.5 TO 2.5 MGD AND UP TO 25,000 LBS PER DAY OF BOD. ACTIVATED SLUDGE OR CONTACT STABILIZATION TREATMENT OF FRUIT PROCESSING WASTE AT LOW RATES WILL PROVIDE GREATER THAN 90% REMOVAL OF ORGANIC LOAD AND SOLIDS FROM THE EFFLUENT. AERATED LAGOON TREATMENT CAN PROVIDE GREATER THAN 80% BOD REMOVAL BUT SUSPENDED SOLIDS REMAIN IN THE EFFLUENT. FINAL CLARIFICATION IS SUCCESSFUL BY LOW SURFACE LOADING RATES, LESS THAN 400 GPD PER SQ. FOOT. NUTRIENT ADDITION IS NECESSARY TO ACHIEVE SUCCESSFUL TREATMENT. THE COST OF THE TREATMENT IS ESTIMATED AT $0.41 PER POUND OF BOD REMOVED FROM AERATED LAGOONS, $0.061 PER POUND OF BOD REMOVED FROM ACTIVATED SLUDGE AND $0.067 PER POUND OF BOD REMOVED FROM CONTACT STABILIZATION. DATA WERE COLLECTED ON BIOLOGICAL SUBSTRATE ASSIMILATION, SLUDGE GROWTH, OXYGEN UPTAKE AND SLUDGE SETTLEABILITY. CONSTANTS WERE OBTAINED FOR SUBSTRATE REMOVALS, SLUDGE GROWTH RATE, ENDOGENOUS RESPIRATION AND OXYGEN REQUIREMENTS. (W71-01848).

00425. GOOD MANAGEMENT INCLUDES EFFECTIVE SAFETY PROGRAMS.

ROGERS, B.G.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42(9), 1614-1620, 1970.

THROUGH SURVEYS OF WASTE WATER COLLECTION AND TREATMENT SYSTEMS IN THE UNITED STATES THE WATER POLLUTION CONTROL FEDERATION HAS DETERMINED THAT THE SAFETY RECORD IN THE WASTE WATER POLLUTION CONTROL FIELD IS WORSE THAN THAT IN ANY OF 41 INDUSTRIES REPORTING REGULARLY TO THE NATIONAL SAFETY COUNCIL. THIS POOR RECORD IS COSTING THE FIELD MORE THAN $30,000,000 EACH YEAR IN ADDED INSURANCE COST, LOST TIME AND REDUCED PRODUCTIVITY. PERSONNEL MORALE AND PUBLIC IMAGE ARE AMONG OTHER FACTORS SUSTAINING DAMAGE BUT TO WHICH NO MONETARY VALUE MAY BE ASSIGNED. THE FEDERATION HAS DEVELOPED SAFETY PROMOTIONAL MATERIALS AIMED AT FIRST CONVINCING MANAGEMENT OF THE NEED FOR AND VALUE OF SAFETY PROGRAMS AND GOING ON TO FURNISH SPECIFIC AIDS AND TRAINING MATERIALS FOR SAFETY. (W71-01850).

00426. AN ECONOMIC STUDY OF THE EFFECT OF MUNICIPAL SEWER SURCHARGES ON INDUSTRIAL WASTES.

ETHRIDGE, D.E.
WATER RESOURCES RESEARCH INSTITUTE, REPORT NO 41, NOVEMBER 1970. 122 P.

THIS STUDY ANALYZES THE INDUSTRIAL RESPONSE TO SEWER SURCHARGES (1) IN A THEORETICAL FRAMEWORK AND (2) USING TWO EMPIRICAL ESTIMATION PROCEDURES. THE PURPOSE IS TO DEVELOP AND APPRAISE ALTERNATIVE METHODS OF STUDYING THE RESPONSE OF SPECIFIC INDUSTRIES. A SYNTHETIC OR BUDGETING APPROACH WAS USED TO ESTIMATE FIRMS' RESPONSES FOR THE BEET PROCESSING AND POULTRY PROCESSING INDUSTRIES. IT WAS ESTIMATED THAT A TYPICAL BEET PROCESSING PLANT WOULD REDUCE ITS WASTELOAD DISCHARGED BY 75 PERCENT IF FACED WITH A SURCHARGE OF 2 CENTS PER POUND OF BOD (FROM 31,600 POUNDS OF BOD (BIOCHEMICAL OXYGEN DEMAND) PER DAY WITH NO SURCHARGE TO 7,770 POUNDS OF BOD PER DAY WITH A SURCHARGE OF 2 CENTS PER POUND OF BOD). THE CORRESPONDING ESTIMATE FOR A POULTRY PROCESSING PLANT WAS A REDUCTION OF 32 PERCENT. IT WAS ESTIMATED THAT THE ELASTICITY OF TOTAL POUNDS OF BOD DISCHARGED BY BEET PROCESSING PLANTS WITH RESPECT TO THE SURCHARGE ON BOD IS -.7 AT A 'TYPICAL' SURCHARGE OF APPROXIMATELY 2 CENTS PER POUND OF BOD. THE CORRESPONDING ELASTICITY ESTIMATE FOR POULTRY PROCESSING PLANTS WAS ESTIMATED TO BE -.15. REGRESSION ANALYSIS WAS ALSO USED TO ESTIMATE FIRMS' RESPONSES FOR THE POULTRY PROCESSING INDUSTRY. THE RESULTING ESTIMATE OF THE ELASTICITY OF TOTAL POUNDS OF BOD DISCHARGED WITH RESPECT TO THE SURCHARGE WAS -.23. (PB-195 981) (W71-01897).

00427. ADVANCED WASTE TREATMENT IN NASSAU COUNTY, NEW YORK, WATER PROVIDED

FOR INJECTION INTO GROUNDWATER AQUIFERS.

ROSE, J.L.
WATER AND WASTE ENGINEERING, 7(2), 38-39, 1970.

TO MEET A THREAT OF SALT WATER INTRUDING INTO ITS AQUIFERS, NASSAU COUNTY, NEW YORK, CONSIDERED A PROPOSAL WHICH WOULD ALLOW AN INCREASE OF THE PERMISSIBLE WITHDRAWALS, TO CREATE A HYDRAULIC BARRIER IN THE AQUIFER, WHICH WOULD PREVENT BOTH THE NATURAL OUTFLOW, NOW LOST TO THE SEA, AND THE INTRUSION OF SALT WATER. THE BARRIER WOULD BE FORMED BY INJECTING TREATED WASTE WATER THROUGH A SERIES OF RECHARGE WELLS. FOR EVALUATION PURPOSES, A 400 GPM DEMONSTRATION PLANT WAS CONSTRUCTED. THE PLANT PROVIDES TERTIARY TREATMENT FOR THE EFFLUENT OF THE CONVENTIONAL ACTIVATED SLUDGE PLANT. THE PRODUCT WATER IS PUMPED ABOUT ONE-HALF MILE TO A TEST INJECTION SITE. THE TERTIARY TREATMENT PLANT IS A CONVENTIONAL WATER TREATMENT PLANT MODIFIED TO UTILIZE SECONDARY EFFLUENT AS A WATER SOURCE. EFFLUENT IS PUMPED INTO A CLARIFIER TO WHICH ALUM AND COAGULANT AIDS ARE ADDED. THE SUPERNATANT FLOWS BY GRAVITY TO TWO MIXED MEDIA FILTERS OPERATED IN PARALLEL. FINAL BACKWASH IS SEMI-AUTOMATIC AND INCLUDES AIR SCOUR, SURFACE WASH, AND HIGH- AND LOW-RATE BACKWASHING. FILTER EFFLUENT IS PUMPED THROUGH FOUR GRANULAR ACTIVATED CARBON ADSORBERS. THE RENOVATED WATER IS DISINFECTED WITH CHLORINE BEFORE BEING PUMPED TO THE INJECTION SITE. THE INJECTION FACILITIES CONSIST OF A STORAGE TANK, A DEGASIFIER FOR REMOVAL OF DISSOLVED GASES, INJECTION AND REDEVELOPMENT PUMPS, AN INJECTION WELL, AND 12 OBSERVATION WELLS. THE INJECTION WELL IS 36 INCHES IN DIAMETER BY 500 FEET DEEP AND CONTAINS AN OBSERVATION WELL AND GEOPHYSICAL PROBES. COSTS ARE TABULATED. OPERATION OF THE TERTIARY TREATMENT PLANT AND INJECTION SYSTEM SINCE JANUARY, 1968, CONFIRMS THE CONCEPT OF RECHARGING WASTE WATERS INTO THE AQUIFER. THE WELL HAS BEEN REDEVELOPED AFTER EACH SERIES OF INJECTION TESTS WITH NEGLIGIBLE LOSS OF CAPACITY. THE TREATMENT PLANT HAS CONSISTENTLY PRODUCED WATER MEETING THE INJECTION QUALITY CRITERIA. (W71-01970).

00428. WASTE WATER RECLAMATION AND REUSE.

SEBASTIAN, F.P.
WATER AND WASTE ENGINEERING, 7(2), 46-47, 19709.

IN MARCH 1968 THE SOUTH TAHOE (CALIF.) WATER RECLAMATION PLANT, THE FIRST, LARGEST AND MOST FULLY INTEGRATED PLANT IN THE WORLD TODAY PRODUCING WATER OF POTABLE QUALITY DIRECTLY FROM SEWAGE EFFLUENT, BEGAN OPERATION AND HAS SINCE PROCESSED ONE BILLION GALLONS OF WASTE WATER, ENOUGH DRINKING WATER QUALITY EFFLUENT FOR THE ANNUAL HOUSEHOLD NEEDS OF 30,000 PEOPLE. THE INCREMENTAL COST OF DISCHARGING SECONDARY EFFLUENT IS $. 166 PER 1000 GALLONS. THE STATED OPERATIONAL COST INCLUDES CARBON ADSORPTION AND REGENERATION AT $. 036 PER 1000 GALLONS. PUBLIC RESISTANCE TO THE USE OF RENOVATED WATER IS LESSENING. USE OF THIS TYPE OF WATER IN LONG DISTANCE SPACE FLIGHTS WILL HELP INCREASE PUBLIC ACCEPTANCE. ACCORDING TO THE U. S. PUBLIC HEALTH SERVICE, DRINKING WATER STANDARDS DO NOT APPLY TO DIRECT USE OF RECLAIMED WATER FOR DRINKING. RESEARCH IS REPORTEDLY PLANNED TO ESTABLISH THE NEEDED STANDARDS FOR WATER FROM HEAVILY POLLUTED SOURCES. THE POTENTIAL BENEFITS OF PURIFIED WASTE WATER ARE GREATER THAN THE INCREMENTAL COSTS. THE VALUE OF SECONDARY EFFLUENT IS GENERALLY NIL, WHEREAS TERTIARY EFFLUENT RANGES IN VALUE FROM $. 09 PER 1000 GALLONS TO THE COST VALUE OF FRESH WATER, ON SAN FRANCISCO PENINSULA, OF $. 18 TO $. 376 PER 1000 GALLONS. THE VIRTUAL ELIMINATION OF BIOSTIMULANTS AND ELIMINATION OF THE NEED FOR OCEAN OUTFALLS WITH UNKNOWN EFFECTS ON BAY AND OCEAN ECOLOGY CAN BE ACCOMPLISHED WITH TERTIARY TREATMENT. A SIMPLIFIED FLOWSHEET OF SOUTH TAHOE WATER RECLAMATION PLANT IS INCLUDED IN THE ARTICLE. (W71-01979).

00429. FEASIBILITY OF GRANULAR, ACTIVATED-CARBON ADSORPTION FOR WASTE WATER RENOVATION.

JOYCE, R.S.; SUKENIK, V.A.
FWQA ROBERT A TAFT SANITARY ENGINEERING CENTER, REPORT AWTR-10, MAY 1964.

THIS STUDY WAS INITIATED TO ESTIMATE THE OPTIMUM BED DEPTH AND FLOW RATES NECESSARY FOR MOST ECONOMICAL USE OF THE ADSORPTIVE PROPERTIES OF CARBON AND TO EXAMINE THE FEASIBILITY OF REGENERATING THE CARBON. THE RESULTS SHOW THAT GRANULAR ACTIVATED CARBON IN PACKED-BED COLUMN CONTRACTORS REMOVES MUCH OF THE ORGANIC MATTER INCLUDING ALKBENZENE-SULFONATE FROM MUNICIPAL WASTE WATER. THE COD OF A SECONDARY EFFLUENT WAS REDUCED TO ABOUT 12 TO 20 PPM AND THE ABS WAS REMOVED ALMOST ENTIRELY. WHEN AN ABS BREAKTHROUGH CONCENTRATION OF 0.5 PPM IS USED AS A CRITERION OF CARBON EXHAUSTION, THE AMOUNT OF CARBON REQUIRED FOR COUNTERCURRENT CONTACTING IS LESS THAN ONE POUND PER 1,000 GALLONS. FOR THE PROCESS TO BE ECONOMICAL THE CARBON MUST BE REACTIVATED AND RE-USED. THERMAL REACTIVATION IN A STEAM-AIR ATMOSPHERE WAS FOUND TO BE TECHNICALLY FEASIBLE. WITH REACTIVATION, THE TOTAL COST OF CARBON ADSORPTION WAS ESTIMATED TO BE LESS THAN 10 CENTS PER 1,000 GALLONS FOR PLANTS TREATING 10 MGD OF WASTE WATER. (PB-168 838) (W71-02280).

00430. POULTRY MANURE LAGOON DESIGN.

PARSONS, R.A.; PRICE, F.; FAIRBANK, W.C.
POULTRY DIGEST, 29(344), 485-488, 1970.

THIS PAPER DEALS WITH LAGOON DESIGN CRITERIA FOR POULTRY MANURE. A LAGOON IS A SATISFACTORY MEANS OF POULTRY MANURE DISPOSAL. THE LAGOON SHOULD BE USED ONLY IN RURAL AREAS THAT ARE TOLERANT OF VARIED BUT DILUTE ODORS OF FARM PRODUCTION. OVERLOADING IS ABOUT THE ONLY CAUSE OF LAGOON MALFUNCTION. SIZE REQUIREMENTS, CONSTRUCTION, FLUSHING SYSTEM, COSTS, AND LAGOON OPERATION ARE DISCUSSED. (W71-02700).

00431. INDUSTRIAL BY-PRODUCT RECOVERY BY DESALINATION TECHNIQUES.

OFFICE OF SALINE WATER RESEARCH AND DEVELOPMENT PROGRESS REPORT NO 581, OCTOBER 1970. 314 P.

A STUDY WAS MADE OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF USING DESALINATION METHODS AND EQUIPMENT FOR THE RECOVERY OF MATERIALS FROM INDUSTRIAL PLANT WASTE STREAMS. IT WAS DETERMINED THAT A VERY SUBSTANTIAL MARKET FOR THIS EQUIPMENT EXISTS AND THAT DESALINATION TECHNOLOGY CAN CONVERT MANY WASTE DISPOSAL PROBLEMS INTO

PAYING RECOVERY SITUATIONS. IT WAS ESTIMATED THAT OVER ONE BILLION DOLLARS IN DESALINATION EQUIPMENT COULD BE UTILIZED IN VARIOUS WASTE RECOVERY AND PROCESSING OPERATIONS. THE MOST PROMISING INDUSTRIES ARE: PULP AND PAPER, CHEESE AND DAIRY, IRON AND STEEL, PLATING AND METAL FINISHING, NUCLEAR POWER PLANTS, ACID MINE DRAINAGE. (GPO $2.50) (W71-03004).

00432. SYSTEMS ANALYSIS OF BRINE DISPOSAL FROM REVERSE OSMOSIS PLANTS.

LEGROS, P.G.; GUSTAFSON, C.E.; SHEPHERD, B.P.; MCILHENNY, W.F.

RESEARCH AND DEVELOPMENT PROGRESS REPORT NO 587, AUGUST 1970. 202 P.

REVERSE OSMOSIS DESALTING SYSTEMS WERE ANALYZED FOR SIX INLAND LOCATIONS TO DETERMINE THE EFFECTS OF DISPOSAL METHODS ON TOTAL SYSTEM COST. COMMUNITIES WERE SELECTED WHICH WOULD REPRESENT A RANGE OF FEEDWATER TYPES, EVAPORATION RATES AND UNDERGROUND GEOLOGY. THE SIX COMMUNITIES WERE MINOT, N. D. , ARKANSAS CITY, KANSAS; CLINTON, OKLAHOMA; MIDLAND, TEXAS; GALLUP, NEW MEXICO; AND FORT MORGAN, COLORADO. THE DESALTING SYSTEM WAS DIVIDED INTO ITS FUNCTIONAL COMPONENTS: FEEDWATER ACQUISITION, PRETREATMENT, REVERSE OSMOSIS, WASTE PRECONDITIONING AND WASTE DISPOSAL. ENGINEERING DESIGNS WERE PREPARED AND COSTS ESTIMATED FOR THE INTAKE, SOURCE WELL, DISPOSAL WELL AND EVAPORATION POND ELEMENTS AT SEVERAL LEVELS OF FLOW RATE. UNIT COSTS WERE DERIVED FOR THE VARIOUS ELEMENTS FOR PLANT RECOVERY RATES FROM 0.5 TO 0.98. FOR THE SIX CASE COMMUNITIES THE MOST ECONOMICAL OPERATING RECOVERY FACTORS RANGED BETWEEN 0.9 AND 0.98. PRODUCT WATER UNIT COSTS OF THE SEVERAL FUNCTIONAL COMPONENTS WERE COMBINED TO GIVE THE TOTAL SYSTEM COST. LOWEST TOTAL SYSTEM UNIT COSTS FOR THE 1 MGD CAPACITY SYSTEM RANGED FROM $0.84 TO $0.84 TO $1.10 PER 1000 GALLONS OF FRESH WATER. (GPO $1.75) (W71-03216).

00433. COST OF PURIFYING MUNICIPAL WASTE WATERS BY DISTILLATION.

GERSTER, J.A.

ENVIRONMENTAL HEALTH SERIES AWTR-6, ADVANCED WASTE TREATMENT RESEARCH PROGRAM, PUBLIC HEALTH SERVICE, ROBERT A TAFT SANITARY ENGINEERING CENTER, NOV 1963. 43 P.

TO ESTIMATE THE COST OF DISTILLATION OF WASTE WATER, DESK TOP STUDIES WERE MADE WITH THE TYPES OF EQUIPMENT PROPOSED FOR USE WITH SEA WATER. THE ESTIMATES ARE BASED UPON THOSE FOR SEA WATER, BUT ARE MODIFIED TO CONFORM WITH THE DIFFERENCES IN THE MODES OF OPERATION FOR THE TWO FEEDS. THE SMALLER CONCENTRATION OF SCALING MATERIALS IN WASTE WATER SHOULD ALLOW DISTILLATION TO BE CARRIED OUT AT A HIGHER TEMPERATURE THAN CAN BE USED WITH SEA WATER. THE SMALLER TOTAL CONTAMINANT CONCENTRATION RESULTS IN A SMALLER BOILING-POINT ELEVATION. BECAUSE OF THE NEED TO DISPOSE OF THE BLOWDOWN PERMANENTLY IT IS NECESSARY TO CONCENTRATE TO A FAR GREATER EXTENT THAN IN THE CASE OF SEA-WATER DISTILLATION. THREE TYPES OF EQUIPMENT--MULTI-STAGE FLASH, MULTIPLE-EFFECT, AND RECOMPRESSION FLASH--APPEAR ECONOMICALLY PROMISING. FOR ALL TYPES OF EQUIPMENT THE COST FOR THE DISTILLATION STEP ALONE IS SOMEWHAT LESS THAN FOR SEA WATER, BUT INCLUSION OF COSTS FOR FEED PRETREATMENT AND ULTIMATE DISPOSAL OF BLOWDOWN BRING THE COST UP TO ABOUT THAT FOR SEA WATER. (PB-168 978) (W71-03510).

00434. THE CONCEPTUAL DESIGN OF AN ECONOMICALLY FEASIBLE ANIMAL WASTE DISPOSAL SCHEME.

OKEY, R.W.; RICKLES, R.N.

RELATIONSHIP OF AGRICULTURE TO SOIL AND WATER POLLUTION, PROCEEDINGS, CORNELL UNIVERSITY CONFERENCE ON AGRICULTURAL WASTE MANAGEMENT, ROCHESTER, JANUARY 19-21, 1970, 1970, P 85-97.

BASED ON EARLIER WORK, A COMPLETE SYSTEM FOR THE CAPTURE, TRANSPORT AND TREATMENT OF THE WASTES FROM A 25,000 ANIMAL LOT WAS PRESENTED. SYSTEM CAPITAL COSTS ARE SEEN TO BE ABOUT $1.00 - $2.00/TON, AND OPERATING COSTS ARE AROUND $3.00 - $4.00 PER TON OF WET WASTE. THESE COSTS RESULT IN A COST/LB GAINED OF LESS THAN HALF A CENT TO ABOUT A CENT. THE COSTS FOR THE LEAST EXPENSIVE SYSTEM ARE AN ORDER OF MAGNITUDE BELOW FEED COSTS. THE INSTALLATION COSTS ARE IN THE ORDER OF $15.00 TO $40.00/ANIMAL OR LESS THAN THE CAPITAL COST AS THE LEAST EXPENSIVE CONFINEMENT SCHEME. ECONOMIC FEASIBILITY IS A COMBINATION OF MANY THINGS. ONE OF THE MOST IMPORTANT IS THE RELEVANCE OF A PARTICULAR ITEM WHEN ALL THE COSTS ARE CONSIDERED. THE COSTS OF WASTE TREATMENT AT FEEDLOTS WOULD APPEAR TO REPRESENT ROUGHLY THE SAME FRACTION OF THE TOTAL COSTS AS SEEN IN OTHER INDUSTRIES. (W71-03546).

00435. DRYING ANIMAL WASTE.

SURBROOK, T.C.; BOYD, J.S.; ZINDEL, H.C.

RESEARCH REPORT 117, FARM SCIENCE, MSU AGRICULTURAL EXPERIMENT STATION, EAST LANSING, JULY 1970, P 16-20.

THE REPORT GIVES DETAILS AND TEST RESULTS FROM A MACHINE USED FOR DRYING ANIMAL WASTE. PRODUCTION FIGURES FOR THE DRIER WHILE PROCESSING DIFFERENT KINDS OF ANIMAL EXCRETA ARE GIVEN. DETAILS OF THE DRIER OPERATION ARE DESCRIBED. INITIAL MOISTER CONTENTS RANGED FROM 72 TO 82 PERCENT. THE MACHINE INCORPORATES INCLINED SHAKING SURFACES AND SCREENS, A HAMMERMILL AND TEMPERATURES FROM 200 TO 1100 DEG F. THE DRIER SUCCESSFULLY PROCESSED DAIRY, BEEF, SWINE AND POULTRY EXCRETA. COSTS TO PRODUCE ONE TON OF THE DRIED PRODUCT ARE GIVEN. A TABLE GIVES PROJECTED NUMBERS OF ANIMALS WHICH THE MACHINE MIGHT SERVE. DENSITY AND NUTRIENT LEVELS OF THE DRIED EXCRETA ARE LISTED. ODORS WERE LESS INTENSE THAN THAT OF FRESH EXCRETA. (W71-03559).

00436. HOG WASTE DISPOSAL BY LAGOONING.

CLARK, C.E.

JOURNAL OF THE SANITARY ENGINEERING DIVISION, PROCEEDINGS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, 91(SA6), P27-41, 1965.

THE MATERIAL PRESENTED CONSISTS OF ON-SITE OBSERVATIONS AND TEST RESULTS OBTAINED FROM SAMPLES COLLECTED FROM AN OPERATIONAL FARM LAGOON IN ILLINOIS. THE PROGRAM CENTERED ON THIS LAGOON SINCE OTHERS AROUND IT HAD FAILED. THE SYSTEM ITSELF IS DESCRIBED AND POSSIBLE SOLUTIONS GIVEN AS TO WHY IT DOES WORK. CHEMICAL PROPERTIES OF THE

LAGOON SUPERNATANT AND THE RAW WASTE ARE COMPARED ON THE BASIS OF OBSERVATIONS MADE DURING THIS PROGRAM. THE MOST LIKELY PROBLEM WILL BE PROCESS FAILURE CAUSED BY ANTIBIOTIC EFFECT, TEMPERATURE CHANGE OR SHOCK LOADING. STUDIES ARE UNDERWAY CONCERNING THE HARVESTING AND FEEDING OF ALGAE FROM THE LAGOON. OPERATIONAL PROBLEMS AS WELL AS COSTS ARE EVALUATED FOR THE TOTAL SYSTEM. FINALLY, A PRACTICAL SYSTEM IS SUGGESTED FOR THE DISPOSAL OF HOG WASTES. (W71-03578)

00437. POULTRY MANURE DISPOSAL - IS THERE A PROBLEM.

RILEY, C.T.
AGRICULTURE, VOL 73, 1966, P 110-112.

THE COST IS EXAMINED ASSOCIATED WITH REMOVAL OF POULTRY MANURE FROM THE HOUSE TO THE DISPOSAL POINT. IT IS COSTING THE POULTRY FARMER A SHILLING PER BIRD PER YEAR TO REMOVE THE MUCK. THE FERTILIZER VALUE OF POULTRY MANURE SHOULD NOT BE OVERLOOKED. FARMERS DISPOSE ENOUGH MANURE THAT WOULD BE WORTH 160 UNITS OF NITROGEN, 160 UNITS OF PHOSPHORUS AND 70 UNITS OF POTASH IF APPLIED TO A CROP. (W71-03579)

00438. SWINE WASTE MANAGEMENT--OXIDATION DITCH FOR TREATING HOG WASTES.

MUEHLING, A.J.
COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN, AUGUST 1969, 2 P.

THERE HAS BEEN CONSIDERABLE INTEREST IN AEROBICALLY TREATING HOG WASTES IN AN OXIDATION DITCH BECAUSE OF THE NEED FOR A LOW-ODOR METHOD OF MANURE STORAGE AND TREATMENT. THIS FACT SHEET GIVES GUIDELINES AS TO DESIGN SHAPE, CAPACITY AND LOADING, ROTOR CAPACITY AND IMMERSION, LIQUID DEPTH AND RATE OF FLOW. OPERATIONAL PROCEDURES ARE GIVEN AS WELL AS A DISCUSSION OF PROBLEMS THAT MAY ARISE. SOLUTIONS TO THE PROBLEM OF FOAMING INCLUDE VEGETABLE OR PETROLEUM OIL, COMMERCIAL PRODUCTS OR A WATER SPRAY. SLUDGE BUILDUP AND FINAL DISPOSAL ARE GIVEN SOME ATTENTION. ROTOR COSTS ARE ABOUT $250 PER FOOT AND OPERATION COSTS ARE ESTIMATED TO BETWEEN 1/2 AND 1 CENT PER DAY PER HOG. (W71-03587)

00439. A GROWING MARKET FOR WATER AND WASTEWATER TREATMENT EQUIPMENT.

KOLLAR, K.L., YOUNGWIRTH, W.G.
WATER AND SEWAGE WORKS, 117(9), 319-325, 1970.

THIS PAPER PRESENTS DATA OBTAINED FROM QUESTIONNAIRE RESPONSE OF WATER AND WASTE WATER TREATMENT EQUIPMENT MANUFACTURERS. THE QUESTIONS RELATED TO THE MANUFACTURING PLANT CAPACITY, AND THE VALUES OF SHIPMENTS OF VARIOUS KINDS OF WATER AND WASTE WATER TREATMENT EQUIPMENT. THE RESULTS OF SURVEYS CONDUCTED IN 1965 AND 1968 ARE REPORTED. TABULATED DATA INCLUDE: A SUMMARY OF TOTAL EXPENDITURES AND VALUES OF SHIPMENTS OF MAJOR EQUIPMENT ITEMS; THE SIZES OF MANUFACTURING ESTABLISHMENTS BASED ON THE VALUE OF SHIPMENTS, THE VALUE OF ALL SHIPMENTS OF SPECIFIC EQUIPMENT ITEMS BROKEN DOWN INTO WATER TREATMENT AND WASTE TREATMENT CATEGORIES, VALUES OF TOTAL SHIPMENTS AND PRODUCTION CAPACITIES FOR PLANTS MANUFACTURING WATER AND WASTE WATER TREATMENT EQUIPMENT, A COMPARISON OF THE GROSS NATIONAL PRODUCT, TOTAL MUNICIPAL WATER AND WASTE WATER EXPENDITURES, AND FEDERAL GRANTS. IN ADDITION, CHARTS SHOWING MUNICIPAL EXPENDITURES FOR WATER SUPPLY AND WASTE WATER DISPOSAL FROM 1960 TO 1980 (EST.) ARE GIVEN. THE COLLECTED DATA INDICATE THAT WATER AND WASTE WATER TREATMENT EQUIPMENT ACCOUNT FOR 4.2% OF TOTAL MUNICIPAL EXPENDITURES AND 15.9% OF TOTAL MUNICIPAL TREATMENT FACILITIES EXPENDITURES. APPROXIMATELY 11.2% OF INDUSTRIAL CONSTRUCTION COSTS ARE FOR WATER AND WASTE WATER TREATMENT EQUIPMENT. (W71-03597)

00440. WATER QUALITY ENVIRONMENT AS RELATED TO INDUSTRY.

JENSEN, L.T.
MAN AND THE QUALITY OF HIS ENVIRONMENT, BOULDER, UNIVERSITY OF COLORADO PRESS, 1968, P 59-65.

THE IMPORTANCE IS OUTLINED OF ADEQUATE WATER RESOURCES TO INDUSTRIAL ENTERPRIZES AS WELL AS THE NATURE OF INDUSTRIAL WATER USE. THIS NEED FOR GOOD QUALITY WATER IS OFTEN IN CONFLICT WITH THE NEEDS OF OTHER WATER USERS AND THE PROBLEMS OF THIS DIVERGENCE ARE DISCUSSED. AS AN EXAMPLE OF AN EFFECTIVE INDUSTRIAL PROGRAM THE AUTHOR EXPLAINS THE SITUATION OF THE GREAT WESTERN SUGAR COMPANY WHICH INVOLVES IN-PLANT CONTROL OF WASTES, THEN MOVES TO BY PRODUCT RECOVERY, THEN REUSE, THEN RECYCLING AND FINALLY TREATMENT. THERE ARE A NUMBER OF DIFFERENT ALTERNATIVES AVAILABLE FOR WATER QUALITY MANAGEMENT WHICH INVOLVE DIFFERENT PRICES FOR WATER DUE TO DIFFERENT TREATMENT COSTS. MEETING FUTURE WATER NEEDS WILL NECESSITATE A CONSIDERABLE AMOUNT OF PLANNING AND WILL BE EXTREMELY COSTLY. (W71-03604)

00441. ECONOMICS OF WATER QUALITY.

TIMMONS, J.F.
WATER POLLUTION CONTROL AND ABATEMENT, IOWA STATE UNIVERSITY PRESS, 1965, P 33-50.

WATER QUALITY PROBLEMS ARE EXPLAINED WITHIN AN ECONOMIC FRAMEWORK DESIGNED FOR MAXIMIZING THE SATISFACTION OF HUMAN WANTS FROM THE USE OF WATER. THIS STUDY CONSIDERS BOTH THE DIRECT AS WELL AS DERIVED DEMANDS FOR WATER IN ADDITION TO THE GOODS AND SERVICES WATER HELPS PRODUCE. INVESTIGATION IS MADE INTO THE NATURE OF AND THE GROWING DEMAND FOR WATER AND THE ECONOMIC DIMENSION OF WATER QUALITY PROBLEMS IN RELATION TO PHYSICAL AND STRUCTURAL DIMENSIONS, SUPPLY AND DEMAND CHARACTERISTICS, USE INTERRELATIONSHIPS, AND COSTS AND BENEFITS ASSOCIATED WITH PARTICULAR USES AND USE METHODS. (W71-03612)

00442. THE DISTRIBUTION OF THE BURDEN OF SEWER USER CHARGES UNDER VARIOUS CHARGE FORMULAS.

JOHNSON, J.A.
THE NATIONAL TAX JOURNAL, 29(3), 472-485, 1969.

THIS PAPER ANALYZES ONE TYPE OF USER CHARGE - THE SEWER SERVICE CHARGE IN TERMS OF EQUITY, RESOURCE ALLOCATION, REVENUE AND ADMINISTRATIVE OBJECTIVES. THE MODEL DIVIDES USERS INTO RESIDENTIAL, COMMERCIAL AND INDUSTRIAL CATEGORIES. THE BURDEN FOR EACH CATEGORY IS THEN COMPUTED UNDER TEN SEWER CHARGE FORMULAS BY APPLYING THE

CHARGES TO A MODEL OF A LARGE EASTERN CITY. THE MEASURE OF BURDEN IS THE PERCENTAGE OF REVENUE THAT WOULD BE PAID BY CATEGORIES OF USERS UNDER EACH OF THE SEWER CHARGES. THE RESULTS INDICATE A LARGE VARIANCE IN THE DISTRIBUTION OF THE REVENUE BORNE AMONG THE THREE CATEGORIES OF USERS. THE RESIDENTIAL SHARE IS HIGHEST WHEN THERE IS A FLAT OR MINIMUM FEE WITH THE COMMERCIAL SHARE BEING LARGEST WHEN THE CHARGE IS BASED ON PROPERTY VALUE. THE INDUSTRIAL SHARE IS GREATEST IF THE CHARGE BASIS IS SEWAGE STRENGTH BUT IT IS ALSO HIGH FOR A FIXED RATE. IT IS DIFFICULT TO DETERMINE EQUITY AND RESOURCE ALLOCATION OBJECTIVES WHICH ARE SATISIFED IN A FORMULA. HENCE, FORMULA CHOICE DEPENDS ON THE RELATIVE WEIGHTS PLACED ON THE FOUR OBJECTIVES. THE MOST EFFICIENT FORMULAS BY OBJECTIVE ARE: FOR EQUITY, PROPERTY ASSESSMENT; FOR RESOURCE ALLOCATION, RATE PER UNIT OF VOLUME AND STRENGTH; FOR REVENUE, ALL FORMULAS; AND FOR ADMINISTRATION, FLAT FEE AND PROPERTY ASSESSMENT. (W71-03629)

00443. POLLUTION, PROPERTY AND PRICES.

DALES, J.H.
TORONTO, UNIVERSITY OF TORONTO PRESS, 1968. 111 P.

THE AUTHOR CONSIDERS POLLUTION AS A SOCIAL PROBLEM INVOLVING COLLECTIVE DECISION-MAKING. THE COSTS OF WASTE DISPOSAL ARE DIVIDED INTO POLLUTION PREVENTION COSTS AND POLLUTION COSTS. COST-BENEFIT ANALYSIS IS ILLUSTRATED AS A METHOD OF DECISION-MAKING ABOUT DIFFERENT POLLUTION POLICIES THAT ARE SELECTED THROUGH POLITICAL DECISION-MAKING. THE TREATMENT OF AIR AND WATER AS UNRESTRICTED COMMON PROPERTY IS QUESTIONED WITH A MORE SOPHISTICATED APPROACH SUGGESTED TO PROPERTY RIGHTS. THE BEST STRATEGY, THE AUTHOR SUGGESTS, FOR REDUCING WASTE DISPOSAL COSTS IS A SYSTEM OF CHARGING FOR USER RIGHTS WITH THE GOVERNMENT SETTING THE LEVEL OF PERMISSABLE POLLUTION. THIS BOOK IS RELEVANT FOR WATER RESOURCE PLANNERS CONCERNED WITH RESOURCE ALLOCATION. (W71-03630)

00444. COSTS AND MANPOWER FOR MUNICIPAL WASTE WATER TREATMENT PLANT OPERATION AND MAINTENANCE, 1965-1968.

MICHEL, R.L.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42(11), 1883-1910, 1970.

BETWEEN 1965 AND 1968, DATA WAS TAKEN FROM 1,600 PLANTS DURING A STUDY OF LABOR, ELECTRICAL, AND CHEMICAL COSTS OF WASTE WATER TREATMENT OPERATION AND MAINTENANCE. UNIT COSTS (DOLLARS OR MAN-HOURS EXPENDED PER UNIT LOAD) DECLINED EXPONENTIALLY WITH INCREASED PLANT SIZE, THEREBY SHOWING ECONOMICS OF SCALE. LABOR AND SUPERVISION ACCOUNTED FOR 50 TO 60% OF OPERATION AND MAINTENANCE EXPENDITURES, WITH ELECTRIC POWER RANKING NEXT IN IMPORTANCE, PARTICULARY IN ACTIVATED SLUDGE PLANTS. CHLORINATION OPERATING EXPENSES WERE ABOUT 3% OF TOTAL OPERATING COSTS. OXIDATION LAGOONS WERE SHOWN TO BE AN INEXPENSIVE FORM OF TREATMENT TO OPERATE. USE OR NON-USE OF SLUDGE PROCESSING EQUIPMENT IS THE MOST CRITICAL FACTOR IN OPERATION AND MAINTENANCE COSTS. VACUUM FILTERS ARE ESPECIALLY EXPENSIVE TO OPERATE. (W71-03815).

00445. SURVEY OF COSTS ON METHODS FOR CONTROL OF ACID MINE DRAINAGE POLLUTION.

STEPHAN, R.W.; LORENZ, W.C.
ATTACHMENT E TO APPENDIX C - THE INCIDENCE AND FORMATION OF MINE DRAINAGE POLLUTION, BUREAU OF MINES REPORT, VOL 18 ON DEVELOPMENT OF WATER RESOURCES IN APPALACHIA, 1967.

THIS REPORT PRESENTS CAPITAL INVESTMENT AND OPERATING COSTS ON THE VARIOUS PROCESSES AND METHODS AVAILABLE FOR THE ABATEMENT OF POLLUTION DUE TO ACID COAL MINE WATER DRAINAGE. THE ABATEMENT MEASURES INCLUDE NEUTRALIZATION, IRON REMOVAL, DEMINERALIZATION, AND PHYSICAL DISPOSAL BY DEEP WELL INJECTION. COST DATA ARE PRESENTED ON THE RECLAMATION OF LAND DISTURBED BY SURFACE AND STRIP MINING OPERATIONS. A SUMMARY OF AVAILABLE DATA RELATING THE VARIOUS SIZE PLANTS FOR TREATING ACID MINE WATER IS REPORTED FOR THE VARIOUS PROCESSES FOR ABATEMENT OF POLLUTION. THE COSTS OF POLLUTION ABATEMENT MEASURES AS DETERMINED IN THIS SURVEY RANGE FROM LESS THAN \$0.07/1,000 GAL. TO \$1.13/1,000 GAL. OF ACID MINE WATER TREATED. (W71-03877).

00446. COST OF PATUXENT RIVER QUALITY MONITORING.

NAUMAN, J.W.; CORY, R.L.
JOURNAL OF AMERICAN WATER WORKS ASSOCIATION, 62(12), 796-798, 1970.

IN OCTOBER 1963, THE USGS INSTALLED A CONTINUOUS WATER-QUALITY DATA COLLECTION SYSTEM ON THE PATUXENT RIVER BRIDGE, NEAR BENEDICT, MD. THE SYSTEM WAS INSTRUMENTED TO PROVIDE BACKGROUND WATER QUALITY DATA FOR CORRELATION WITH SPOT SAMPLES TAKEN ELSEWHERE IN THE ESTUARY AND WITH BIOLOGICAL STUDIES CARRIED ON IN THE VICINITY OF THE BRIDGE. RECORDED PARAMETERS INCLUDED SURFACE AND BOTTOM WATER TEMPERATURES, SURFACE DO, CONDUCTIVITY, TURBIDITY, TIDE STAGE, WIND SPEED AND WIND DIRECTION. TOTAL INSTALLATION AND MAINTENANCE COSTS WERE \$22,200. DISREGARDING INSTALLATION, THE GREATEST COST WAS \$16,200 OR \$2,700 ANNUALLY, FOR ROUTINE MAINTENANCE, RECALIBRATION, AND TRAVEL. OVERALL COSTS FOR THE COLLECTION OF WATER QUALITY DATA AVERAGED \$5,000/YR. THE COST WAS \$625 PER PARAMETER PER YEAR, NOT INCLUDING DATA INTERPRETATION AND PROCESSING. (W71-04115).

00447. TREATMENT OF ACID MINE DRAINAGE BY FOAM SEPARATION.

BIKERMAN, J.J.; HANSON, P.J.; ROSE, S.H.
WATER POLLUTION CONTROL RESEARCH SERIES, DECEMBER 1970, 88 P.

BASIC EXPERIMENTS WERE CONDUCTED TO ESTABLISH THE FEASIBILITY OF FOAM FRACTIONATION IN THE TREATMENT OF ACID COAL MINE DRAINAGE FOR THE REMOVAL OF THE METAL IONS, IRON, CALCIUM, MANGANESE AND MAGNESIUM. THE INDEPENDENT VARIABLES CONTROLLING FOAM SEPARATION OF METAL IONS WERE DETERMINED TO BE THE CONCENTRATION RATIO OF SURFACTANT TO IRON, THE AIR VOLUME THROUGHPUT, THE FOAM DRAINAGE TIME, THE TOTAL DISSOLVED SALT CONTENT AND THE TYPE OF SURFACTANT USED. THE MAJOR PART OF IRON, CALCIUM, MANGANESE AND MAGNESIUM CAN BE FOAM SEPARATED FROM ACID SOLUTION BY PROPER CONTROL OF THE INDEPENDENT VARIABLES

REDUCTION OF RESIDUAL SURFACTANT CONCENTRATION IN THE TREATED WATER AND REDUCTION OF WATER ENTRAINED WITH THE FOAM ARE TWO AREAS IN NEED OF FURTHER INVESTIGATION. FOAM SEPARATION WAS TESTED ON ACID DRAINAGE, PARTIALLY LIME NEUTRALIZED DRAINAGE AND COMPLETE LIMESTONE NEUTRALIZED DRAINAGE. TESTS ON MODEL SOLUTIONS INDICATE THAT TREATMENT OF RAW ACID DRAINAGE IS MOST FEASIBLE AT PRESENT. OPERATING AND CAPITAL COSTS ARE ESTIMATED FOR 0.1 AND 1.0 MGD BATCH TREATMENT PLANTS. (PB-197 470) (W71-04188).

00448. EVALUATION REPORT 1: AUTOMATIC BEAKER SAMPLE CHANGER.

LOBRING, L.B.; BOOTH, R.L.
EPA, WQO, ANALYTICAL QUALITY CONTROL LABORATORY, 1014 BROADWAY, CINCINNATI, OHIO 45202. JANUARY 1970. 5 P.

THE BEAKER BUTLER, MANUFACTURED BY VISION LABORATORIES, INC., ORISKANY, NEW YORK, IS A PROTOTYPE SAMPLE CHANGER THAT PRESENTS LIQUID SAMPLES TO A VARIETY OF ELECTRODES. TO EVALUATE THE POTENTIAL USE OF THIS EQUIPMENT FOR ROUTINE ANALYSES, SAMPLES WERE ANALYZED USING THIS EQUIPMENT AS WELL AS MANUAL METHODS. THE RESULTS, WHICH ARE INCLUDED IN TABLES, SHOW THAT THE AUTOMATED STEP GAVE RESULTS COMPARABLE TO MANUAL METHODS WITH A SIGNIFICANT REDUCTION IN COST AND MAN HOURS. (W71-04192).

00449. REVERSE OSMOSIS DESALTING STATE-OF-THE-ART (1969).

OFFICE OF SALINE WATER RESEARCH AND DEVELOPMENT PROGRESS REPORT NO 611, OCTOBER 1970. 73 P.

THE REPORT REVIEWS CURRENT TECHNICAL AND ENGINEERING ECONOMIC ASPECTS OF THE REVERSE OSMOSIS (RO) DESALTING PROCESS. THE RO PROCESS IS A VIABLE TECHNIQUE FOR THE DESALTING OF BRACKISH WATER FEED. RESEARCH INDICATES THAT SEAWATER DESALTING IS POSSIBLE BUT NOT YET PRACTICAL. BRACKISH WATER PRODUCTION PLANTS WITH CAPACITIES UP TO 100,000 GPD ARE OPERATIONAL. ECONOMICAL RO DESALTING IS STRONGLY DEPENDENT UPON THE OPERATING PERFORMANCE AND ECONOMIC CHARACTERISTICS OF THE MEMBRANE AND ITS SUPPORT STRUCTURE. MUCH OF THE ATTRACTIVENESS OF THE RO PROCESS IS ASSOCIATED WITH THE LOW ENERGY CONSUMPTION REQUIREMENTS. PROJECTIONS OF COSTS ARE MADE FOR PLANTS UP TO 50 MILLION GALLOSN PER DAY OF PRODUCT WATER. (GPO $0.75) (W71-04225).

00450. ECONOMIC AND ADMINISTRATIVE PROBLEMS OF WATER POLLUTION.

CASTLE, E.N.
AGRICULTURE AND THE QUALITY OF OUR ENVIRONMENT, NORWOOD, MASSACHUSETTS, THE PLIMPTON PRESS, P 251-265, 1967.

TECHNICAL INTERDEPENDENCE IN PRODUCTION AND CONSUMPTION PROCESSES CREATES A SITUATION IN WHICH THE LEVEL OF WATER QUALITY CANNOT BE DETERMINED BY THE MARKET. THE AUTHOR FINDS THAT THE LEAST COSTLY METHOD OF ACHIEVING A GIVEN LEVEL OF WATER QUALITY REQUIRES GROUP ACTION. AS AN AID TO THIS GROUP DECISION-MAKING, ECONOMIC EVALUATION STUDIES ARE EXTREMELY USEFUL. THE PAPER REPORTS ON A STUDY OF THE WESTERN PART OF OREGON SURROUNDING THE ESTUARY OF THE JAQUINA RIVER. IT WAS FOUND THAT THE TOOLS EXIST FOR QUANTIFYING RECREATIONAL AND SECONDARY BENEFITS OF WATER QUALITY. (W71-04450).

00451. TANNERY PRE-TREATMENT PLANT DRASTICALLY CUTS BARRE'S TREATMENT PLANT LOAD.

WATER AND POLLUTION CONTROL, P 61-62, APRIL 1970.

GORE AND STORRIE LIMITED OF TORONTO, CANADA, WAS RETAINED TO DESIGN AND SUPERVISE CONSTRUCTION OF A PRE-TREATMENT PLANT FOR TANNERY WASTES. PRIOR TO DESIGN, SEDIMENTATION TESTS, SLUDGE STUDIES, THE EFFECT OF POLYELECTROLYTES, AND WATER USE REDUCTION WERE SCRUTINIZED TO DETERMINE HOW THEY AFFECTED TREATMENT. THE PLANT WAS DESIGNED AND BUILT BY 1968 AT A TOTAL COST OF $195,000 AND CONSISTED OF FACILITIES TO PROVIDE FOR SCREENING, FLOW EQUILIZATION, PRE-AERATION, SETTLING, SLUDGE REMOVAL AND STORAGE, SCUM REMOVAL, FLOW METERING, TANK TRUCK REMOVAL OF SCUM AND SLUDGE, AND UNWATERING. THIS PRETREATMENT SIGNIFICANTLY REDUCED THE SLUDGE VOLUME IN THE CITY'S TREATMENT PLANT. (W71-04488).

00452. TREATMENT OF WINE DISTILLING WASTES BY ANAEROBIC DIGESTION.

STANDER, G.J.
PROCEEDINGS 22ND INDUSTRIAL WASTE CONFERENCE, MAY 2, 3, 4, 1967, PURDUE UNIVERSITY, VOL L II, NO 3, P 892-907, JULY 1968.

A PROGRAM OF OPERATIONAL RESEARCH WITH A FULL-SCALE TREATMENT PLANT LOCATED IN THE MAIN WINE PRODUCING AREA OF SOUTH AFRICA HAS BEEN UNDERTAKEN BY THE CAPE REGIONAL LABORATORY OF THE NATIONAL INSTITUTE FOR WATER RESEARCH (NIWR). LABORATORY AND PILOT SCALE STUDIES HAVE BEEN CONDUCTED FROM 1948 TO DATE AND HAVE INDICATED THAT ANAEROBIC DIGESTION MIGHT PROVIDE A PRACTICAL METHOD FOR DEALING WITH WINE WASTES. THE FULL-SCALE TREATMENT PLANT CONSISTS OF A MODIFIED 'DORR-OLIVER CLARIGESTER' AND THE DESCRIPTION AND OPERATION OF THIS PLANT IS DISCUSSED. MANY UNKNOWN FACTORS WHICH EXISTED IN REGARD TO THE BIOLOGICAL, METABOLIC PATHWAYS, TECHNOLOGICAL, AND PHYSICAL ASPECTS OF THE PRACTICAL OPERATION OF AN ANEROBIC DIGESTOR ARE INCLUDED. THE EFFLUENT FROM THE ANAEROBIC DIGESTION OF SPENT WINE STILL CONTAINS APPROXIMATELY 1.8% OF ITS ORIGINAL COD WHICH AMOUNTS TO ABOUT 400 MG/L AND THIS NEEDS ADDITIONAL STABILIZATION WHICH CAN BE ACCOMPLISHED IN CONVENTIONAL SEWAGE TREATMENT. THE COST OF THIS TYPE OF TREATMENT IS APPROXIMATELY 56 CENTS PER 1000 GALLONS. (W71-04493).

00453. COMBINED WASTE TREATMENT AT GRAND ISLAND, NEBRASKA.

GIBBS, W.R.; BENJES, H. JR.
PROCEEDINGS, 22ND INDUSTRIAL WASTE CONFERENCE, MAY 2, 3, 4, 1967, PURDUE UNIVERSITY, LII (3), 800-812, 1968.

STUDIES WERE UNDERTAKEN TO DETERMINE THE NATURE OF THE INDUSTRIAL WASTES, OF DETERMINING WHETHER THE DOMESTIC AND INDUSTRIAL WASTES COULD BE TREATED MORE ECONIMICALLY AND EFFICIENTLY IN COMBINED OR SEPARATE FACILITIES, AND WHICH PROCESSES OFFERED THE GREATEST ADVANTAGES. THESE EXHAUSTIVE STUDIES LED TO THE

CONCLUSION THAT MAXIMUM EFFICIENCY AND ECONOMY WOULD BE REALIZED BY COMBINED TREATMENT OF DOMESTIC AND INDUSTRIAL WASTES IN A NEW TREATMENT PLANT INCORPORATING THE COMPLETE MIXING ACTIVATED SLUDGE PROCESS, AND ABANDONMENT OF THE EXISTING TREATMENT FACILITIES. A DISCUSSION OF THE PLANNING, DESIGN, OPERATION, PROBLEMS, AND COST ARE INCLUDED. STUDIES ARE CONTINUING OF OPERATIONAL CONTROLS AND PROCESS MODIFICATIONS WHICH ARE ANTICIPATED TO INCREASE THE TREATMENT EFFICIENCY AND REDUCE OPERATING COSTS. (W71-04494).

00454. THE LARGEST OXIDATION DITCH IN THE WORLD FOR THE TREATMENT OF INDUSTRIAL WASTES.

ADEMA, D.

PROCEEDINGS, 22ND INDUSTRIAL WASTE CONFERENCE, MAY 2, 3, 4, 1967, PURDUE UNIVERSITY, (42)3, 717-730, JULY 1968.

AN INVESTIGATION WAS MADE OF THE BIOLOGICAL TREATMENT OF WASTE WATER COMING FROM TWO COKING PLANTS, A PLANT WHOSE EFFLUENT CONTAINED CHEMICALS USED IN THE PREPARATION OF POLYETHYLENE AND FORMALDEHYDE, AND A THIRD TYPE OF PLANT WHICH DISCHARGED LARGE AMOUNTS OF ORGANIC WASTES. A COMPARISON OF THE ACTIVATED SLUDGE PROCESS VERSUS THE OXIDATION WAS MADE AND THE LATTER PROCESS WAS DEEMED TO BE MORE APPROPRIATE FOR TREATMENT OF THIS PARTICULAR WASTE. THE BIOLOGICAL PURIFICATION UNDER NITRIFICATION AND DENITRIFICATION CONDITIONS, THE TROUBLE CAUSED BY A SHORTAGE OF PHOSPHOROUS, MAXIMUM CAPACITY OF THE DITCH AND PLANS TO ENLARGE THE CAPACITY, CAPITAL AND OPERATING COSTS, AND OTHER DATA ON THE PASVEER DITCH ARE DISCUSSED. (W71-04498).

00455. AN EVALUATION OF DIFFUSION MEMBRANES FOR WASTE WATER REHABILITATION.

OKEY, R.W.; FIEDLER, R.A.

7TH INDUSTRIAL WATER AND WASTE CONFERENCE, TEXAS WATER POLLUTION CONTROL ASSOCIATION, JUNE 1 AND 2, 1967, P IV-16-IV-34.

AN ANALYSIS OF THE PERTINENT SYSTEM THEORY, A SERIES OF EXPERIMENTS ON A MEMBRANE SYSTEM, AND AN ECONOMIC ANALYSIS HAVE BEEN CARRIED OUT. THIS EXPERIMENTAL WORK INDICATED THE USE OF A DIFFUSION MEMBRANE SYSTEM AS AN ACTIVATED SLUDGE PHASE SEPARATION DEVICE, A SYSTEM STUDY OF THE FLUX, VELOCITY SOLIDS, AND PRESSURE INTERRELATIONSHIP, AND AN ANALYSIS OF THE MOVEMENT OF PHOSPHORUS THROUGH A MEMBRANE AUGMENTED ACTIVATED SLUDGE FACILITY. THE STUDY OF SYSTEM ECONOMICS INCLUDED INPUTS FROM THE LITERATURE AS WELL AS THE RESULTS OF THE WORK REPORTED HERE. (W71-04512).

00456. DISPOSAL OF BRINES PRODUCED IN RENOVATION OF MUNICIPAL WASTE WATER.

WATER POLLUTION CONTROL RESEARCH SERIES ORD-17070 DLY 05/70, MAY 1970, 113 P.

COSTS OF ULTIMATE DISPOSAL OF BRINE WASTES FROM MUNICIPAL WATER RENOVATION SD DENVER, COLORADO, BASED ON 10 MILLION GALLONS PER DAY, 7% FIXED CHARGE RATE, E INJECTED INTO THE SALINE HUECO BOLSON BASIN AT $0.13/KGAL. SOLAR EVAPORATION S. BRINE CAN BE DUMPED ON WORTHLESS ARID LAND AT A COST OF $.052/KGAL. IT CAN BIN LOCAL PONDS, USING 30 MIL LINERS AND A PIPELINE TO CONVEY RESIDUAL BRINE 50 MILES FOR ULTIMATE DISPOSAL, COSTS $0.18 KGAL. SOLAR EVAPORATION EAST OF DENVER, AND 12 MILLS/KWHR POWER COST, ESTIMATED COSTS ARE AS FOLLOWS: NEAR EL PASO, TEXA USING PONDS WITH A 30 MIL LINER, WOULD COST $0.76/KGAL. ALTERNATELY, SOLAR EVAPORATION EAST OF PUEBLO, COLORADO, IN LINED PONDS WOULD COST $0.96/KGAL., INCLUDING THE PIPELINE FROM DENVER. MULTISTAGE FLASH EVAPORATION TO 10% SOLIDS WOULD REDUCE THE AMOUNT OF BRINE AND THE SIZE OF THE SOLAR PONDS TO A POINT WHERE THEY MIGHT BE ACCEPTABLE. THEIR COMBINED COST, BASED ON $0.46/MBTU STEAM AND STEAM-DRIVEN PUMPS, IS $0.54/KGAL. OF BRINE EFFLUENT. WELL INJECTION IS INFEASIBLE HERE, DUE TO EARTHQUAKES. AT TUCSON, THE TEMPORARY MEASURE OF USING INJECTION WELLS TO 3500 FEET WHILE AWAITING THE SOUTHWEST WATER PLAN WOULD COST $0.13/KGAL. A PERMANENT SCHEME, USING LOCAL SOLAR PONDS WITH 30 MIL LINES WOULD COST $0.18/KGAL., INCLUDING COSTS FOR A RESIDUAL BRINE PIPELINE TO THE WILCOX PLAZA 50 MILES EASTWARD. (PB-197 597) (W71-04614).

00457. CONCEPTUAL ENGINEERING REPORT-- KINGMAN LAKE PROJECT.

WATER POLLUTION CONTROL RESEARCH SERIES 11023 FIX 08/70, AUGUST 1970. 149 P.

THIS CONCEPTUAL ENGINEERING STUDY CONCERNS THE RECLAMATION OF COMBINED SEWER OVERFLOWS AND UTILIZATION OF THE RECLAIMED WATERS IN A MAJOR WATER-ORIENTED RECREATIONAL FACILITY FOR THE DISTRICT OF COLUMBIA. THE INVESTIGATION ENCOMPASSES A COMPREHENSIVE SOLUTION OF ENVIRONMENTAL PROBLEMS BY PROPOSING MULTI-USE OBJECTIVES AND FACILITIES. PRINCIPAL OBJECTIVES OF THE PROJECT INCLUDED: (1) EVALUATION OF RAINFALL RUNOFF RELATIONSHIPS FOR SIZING OF STORAGE AND TREATMENT PLANT CAPACTIIES; (2) CONFIRMATION OF TREATMENT FEASIBILITY USING FILTRATION AND AN ACTIVATED CARBON PROCESS; AND (3) DEVELOPMENT OF SUFFICIENT DATA FOR PRELIMINARY DESIGN PURPOSES. LABORATORY STUDIES NOT ONLY DEMONSTRATED PROCESS FEASIBILITY, BUT SHOWED THE NEED FOR INCLUDING FLOCCULATION AND SEDIMENTATION FOR REMOVAL OF MINUTE PARTICLES, TOGETHER WITH CHLORINE AND IODINE ADDITION FOR MAXIMUM DISINFECTION. THE RECOMMENDED STORAGE/TREATMENT PLANT PROVIDES FOR A 175 MILLION GALLON STORAGE BASIN, A 50 MILLION-GALLON-PER-DAY RECLAMATION FACILITY AND TWO 46-ACRE SWIMMING AND BOATING LAKES. COST EFFECTIVENESS (COST/BENEFIT RATIO) OF THE PROJECT, AS ENVISIONED, HAS BEEN INDICATED TO BE 1.6 AT AN ESTIMATED TOTAL PROJECT COST OF $45,200,000, AND AN ESTIMATED ANNUAL OPERATING COST OF $1,777,000. IMPLEMENTATION OF THE PROPOSED PLAN WOULD NOT ONLY PROVIDE A LEAST-COST ALTERNATIVE OVER SINGLE-PURPOSE PROJECTS TO ATTAIN IDENTICAL OBJECTIVES, BUT WOULD ALSO REDUCE THE ANNUAL POLLUTION NOW DISCHARGED BY THE NORTHEAST BOUNDARY TRUNK SEWER BY APPROXIMATELY 99 PERCENT. (PB-197 598) (W71-04616).

00458. ECONOMICS OF TREATING SEWAGE AND TRADE WASTES.

BRADLEY, R.M.

EFFLUENT AND WATER TREATMENT JOURNAL, P 526-530, 1970.

BOTH CAPITAL AND OPERATING COSTS OF SEWAGE TREATMENT ARE ANALYZED WITH THE CONCLUSION THAT SOME UNCONVENTIONAL TYPES OF SEWAGE TREATMENT (PACKAGED TREATMENT PLANTS) SERVING POPULATIONS LESS THAN 1000 ARE ECONOMICAL. COMPARA-

TIVE COSTS OF TREATMENT BY BIOLOGICAL FILTRATION, OXIDATION DITCH, AND PACKAGED PLANTS ARE GIVEN. ON-SITE INDUSTRIAL SEWAGE PLANTS ARE MORE ECONOMICALLY OPERATED THAN THOSE OF EQUIVALENT CAPACITY FOR MUNICIPAL SEWAGE WORKS, ACCORDING TO COST BREAKDOWNS. ALTHOUGH UNCONVENTIONAL TYPES OF SEWAGE TREATMENT ARE ASSOCIATED WITH INDUSTRIAL WASTES, THEY WOULD BE FEASIBLE FOR MUNICIPAL WASTE PROCESSING. RECENT OPERATIONAL RESULTS INDICATE THAT OXIDATION DITCHES PRODUCE A CONSISTENTLY SATISFACTORY EFFLUENT ALTHOUGH OPERATIONAL COSTS ARE HIGHER THAN FOR CONVENTIONAL WORKS BUT THE MORE RELIABLE EFFLUENT QUALITY AT SUCH LOW POPULATION COST IS COMPENSATORY; ESPECIALLY WHEN DEBT CHARGES ARE CONSIDERED, THE ADVANTAGE OF BOTH OXIDATION DITCHES AND PACKAGED PLANTS BECOMES EVEN MORE ATTRACTIVE. HIGH-RATE BIOLOGICAL FILTERS USING PLASTIC MEDIA HAVE THEIR BIGGER IMPACT FOR ON-SITE INDUSTRIAL WASTE TREATMENT AND FOR RELIEF OF OVERLOADED EXISTING SYSTEMS AND REDUCTION IN LAND AREA. DATA SHOWS THAT INDUSTRIAL TREATMENT PLANT CONSTRUCTION IS 50% OF EQUIVALENT MUNICIPAL SEWAGE WORKS. (W71-04623).

00459. REVERSE OSMOSIS RENOVATION OF MUNICIPAL WASTE WATER.

WATER POLLUTION CONTROL RESEARCH SERIES ORD-17040 EFQ 12/69, 1969. 160 P.

A FIFTEEN-MONTH LABORATORY PROGRAM HAS SHOWN THAT ALL GRADES OF MUNICIPAL WASTE WATER MAY BE SIGNIFICANTLY IMPROVED BY THE REVERSE OSMOSIS PROCESS. COMPARISONS ARE PROVIDED ON THE BEHAVIOR AND RESPONSE OF THE REVERSE OSMOSIS PROCESS TO CARBON-TREATED SECONDARY SEWAGE, ALUM-TREATED SECONDARY SEWAGE, SECONDARY SEWAGE, PRIMARY SETTLED SEWAGE, RAW SEWAGE, AND DIGESTER SUPERNATANT. HIGH REMOVALS OF DISSOLVED MINERALS, ORGANIC SUBSTANCES, AND SUSPENDED MATTER HAVE ALL BEEN ACHIEVED IN THE SAME TREATMENT. THE EFFECTS OF A FLOCCULANT, DISPERSANT, CHELATING AGENT, ENZYME, AND ACID ON REDUCING PRODUCT WATER FLUX DECLINE ARE COMPARED. THE RELATIVE EFFECTS OF REVERSE OSMOSIS TEST-CELL GEOMETRY ON SOLIDS DEPOSITION AND MEMBRANE PERFORMANCE ARE PRESENTED. A PHENOMENOLOGICAL MODEL IS POSTULATED DESCRIBING THE ROLE OF UNDISSOLVED SOLIDS AND ORGANIC SUBSTANCES IN PRODUCING PRODUCT WATER FLUX DECLINE AND THE SUBSEQUENT MAINTENANCE OF CONSTANT PRODUCT WATER FLUXES. A COMPUTER MODEL OF THE REVERSE OSMOSIS PROCESS, COMPATABLE WITH THE EXECUTIVE PROGRAM WRITTEN BY THE FEDERAL WATER QUALITY ADMINISTRATION, HAS BEEN DEVELOPED TO PROVIDE AN ACCURATE AND RAPID METHOD OF DETERMINING THE DESIGN AND COST OF REVERSE OSMOSIS FACILITIES (PB-197 659) (W71-04669).

00460. AMENDED 1964 MASTER PLAN OF WATERWORKS IMPROVEMENTS FOR BOARD OF WATERWORKS COMMISSIONERS, MADISON, WISCONSIN.

BOARD OF WATERWORKS COMMISSIONER, MADISON, WISCONSIN, APRIL 28, 1969. 60 P.

A STUDY WAS CONDUCTED TO : (1) REVIEW AND AMEND A 1964 BLACK AND VEATCH MASTER PLAN OF WATERWORKS IMPROVEMENTS AS SUPPLEMENTED BY A 1967 UNIVERSITY STUDY; (2) CORRELATE NEW POTENTIAL DEVELOPMENT AREAS LOCATED BEYOND THE PRESENT WATER SERVICE AREA WITH THE MADISON UTILITY FACILITIES, (3) EVALUATE WATER USE AND DEVELOPMENT TRENDS DURING THE PAST FIVE YEARS; AND (4) MODIFY PREVIOUSLY RECOMMENDED IMPROVEMENTS RESULTING FROM CHANGED CONDITIONS. THE RECOMMENDATIONS MADE TO THE CITY OF MADISON ARE: (1) CONTINUE PLANNING TO SERVE A POPULATION OF 240,000 BY 1980; (2) GIVE CONSIDERATION TO COMPUTERIZING THE TABULATION OF WATER SALES TO PROVIDE WATER-USE RECORDS; (3) PROVIDE FOR A 1980 MAXIMUM DAILY DEMAND RATE OF 73MGD; (4) INSTALL 167,000 FEET OF WATER MAINS DURING 1969-1974 AND 198,300 FEET DURING 1975-1980; (5) REPLACE THE TWO DAYTON STREET RESERVOIRS; (6) MODIFY EXISTING UNIT WELL STATION BOOSTER PUMPING FACILITIES TO CHANGE DISCHARGE GRADIENTS AND CAPACITIES; (7) CONSTRUCT THREE NEW UNIT WELL SUPPLIES BEFORE 1974 AND ONE BETWEEN 1975 AND 1980; AND (8) CONSTRUCT FIVE NEW GROUND STORAGE RESERVOIRS WITH A TOTAL CAPACITY OF 9 MG. IN ADDITION, MISCELLANEOUS IMPROVEMENTS TO BOOSTER STATIONS, UNIT WELLS AND WATER MAINS ARE RECOMMENDED. THE COST ESTIMATE FOR THE INITIAL (1969-1974) CONSTRUCTION IS $5,202,800. ADDITIONAL REQUIREMENTS DURING THE 1975-1980 PERIOD ARE ESTIMATED AT $4,626,000. (W71-04678).

00461. TOTAL WATER USE.

PROJECT CONSTRUCTION JOINTLY FINANCED BY THE SANTEE COUNTY WATER DISTRICT AND THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, DEPT. OF THE INTERIOR. SANTEE COUNTY WATER DISTRICT, 1968. 16 P.

THE RECENTLY CONSTRUCTED $2,223,944 WASTE WATER RECLAMATION PLANT OF THE SANTEE COUNTY WATER DISTRICT IS RECOGNIZED AS BEING THE MOST ADVANCED FACILITY OF ITS KIND IN THE WORLD. THE PLANT, SERVING ONLY 14,500 PERSONS, WAS BUILT IN LIEU OF JOINING WITH OTHER NEARBY COMMUNITIES IN FORMING A METROPOLITAN SEWER SYSTEM DESIGNED FOR DISPOSAL OF WASTE WATER INTO THE PACIFIC OCEAN. THE PRIMARY REASON FOR THE ADOPTION OF A WATER RECLAMATION SYSTEM WAS THE EXTREMELY HIGH COST OF MUNICIPAL WATER WHICH IS PRESENTLY IMPORTED FROM THE COLORADO RIVER, MORE THAN 300 MILES. THE FACILITY, COMPLETED IN JANUARY 1968, CONSISTS OF A RAW SEWAGE PUMP STATION, A 3.2-MILE LONG SEWAGE FORCE MAIN, AN ACTIVATED SLUDGE TREATMENT PLANT COMPLETE WITH SLUDGE DISPOSAL FACILITIES PLUS AN OXIDATION POND, AN EFFLUENT PUMP STATION, AND A 1.9-MILE LONG EFFLUENT DISTRIBUTION FORCE MAIN, ALL OF WHICH ARE AN INTEGRAL PART OF THE EXISTING RECREATIONAL LAKE AND WATER RECLAMATION FACILITIES. THE RAW SEWAGE IS PUMPED UP SYCAMORE CANYON FOR PROCESSING IN THE NEW TREATMENT PLANT. THE EFFLUENT FLOWS BACK DOWN THE CANYON THROUGH AN OXIDATION POND AND SPREADING BASINS, AND THENCE IS FILTERED THROUGH NATURAL UNDERGROUND AQUIFERS INTO THE RECREATIONAL LAKE SYSTEM FROM WHICH EFFLUENT FOR DISTRIBUTION IS PUMPED. THE RECLAIMED WATER IS USED FOR RECREATIONAL, AGRICULTURAL AND INDUSTRIAL PURPOSES. SLUDGE TREATMENT AND DISPOSAL ARE ACCOMPLISHED BY THE WET AIR OXIDATION (ZIMPRO) PROCESS. THE ENTIRE RECLAMATION SYSTEM IS DESCRIBED AND PHOTOGRAPHS AND DIAGRAMATIC SKETCHES ARE INCLUDED. (W71-04680).

00462. USEFUL ENERGY FROM UNWANTED HEAT.

BREGMAN, J.I.

CHEMICAL ENGINEERING, P 83-87, JANUARY 25, 1971.

ONCE THROUGH COOLING IS CERTAINLY THE MOST ECONOMICAL WAY OF ACCOMPLISHING HEAT DISSIPA-

TION. THE RESULTS OF A STUDY CONDUCTED BY FEDERAL POWER COMMISSION SHOW THAT ABOUT 71 STATIONS IN THE 1,000 TO 4,000 MW RANGE ARE CAPABLE OF BEING SUPPORTED BY RESERVOIRS, 24 IN THE 4,000 TO 12,000 MW RANGE, AND 5 AT 12,000 MW OR GREATER. EFFICIENCY OF A COOLING POND MAY BE INCREASED MARKEDLY BY INTRODUCING A SPRAY INTO THE SYSTEM. COMMON PROBLEMS CONNECTED WITH LARGE COOLING WATERS INCLUDE WOOD DETERIORATION, BIOLOGICAL FOULING, THE FORMATION OF DEPOSITS, CORROSION AND SCALING. ANOTHER MAJOR PROBLEM IS DRIFT AND TOGGING. A TYPICAL TOWER WITH A FLOW OF 250,000 GAL. PER MINUTE OPERATING ON SEAWATER WITH A SALINITY OF 35,000 PPM. AND A DRIFT LOSS OF 0.1 PERCENT WILL EMIT ABOUT 4,400 LB. PER HOUR OF SODIUM CHLORIDE. COSTS FOR DRY TOWER RUN FROM $25 TO $30 PER KW., COMPARED AY BE PARTICULARLY SUITED TO AQUICULTURE. POSSIBILITY OF PLACING A CHEMICAL PLATO $8 TO $13 PER KW. FOR WET TOWERS. COOLING WATER FROM A NUCLEAR POWER PLANT MNT NEXT TO A NUCLEAR PLANT APPEARS ATTRACTIVE. IT IS CONCLUDED THAT POTENTIAL DOES EXIST FOR TURNING WASTE HEAT INTO A USEFUL COMMODITY. (W71-04728).

00463. ECONOMICS OF THERMAL POLLUTION CONTROL.

LOF, G.O.G.; WARD, J.C.
WATER POLLUTION CONTROL FEDERATION JOURNAL, 42(12), 2102-2116, 1970.

APPROXIMATELY 80 PERCENT OF ALL WATER USED BY INDUSTRY IS USED FOR COOLING PURPOSES. PLOTS ARE GIVEN SHOWING THE ESTIMATED COOLING WATER WITHDRAWAL TO THE YEAR 1980 AND FOR ESTIMATES OF PAST AND FUTURE RECIRCULATION. IF THE COST OF SUPPLYING COOLING WATER IN A ONCE THROUGH SYSTEM, INCLUDING WITHDRAWAL, PUMPAGE, AND TREATMENT IF NECESSARY, EXCEEDS ABOUT $0.01/1000 GALLON (0.3 MILL/KWH GENERATED IN FOSSIL FUEL PLANTS), RECIRCULATION COOLING WOULD USUALLY BE EMPLOYED. ONSITE COST WOULD BE MINIMIZED BY SUCH DECISION. REGULATIONS PROHIBITING UNLIMITED THERMAL DISCHARGE ARE THE OTHER REASON FOR USING RECIRCULATION COOLING. EQUATIONS ARE GIVEN FOR CALCULATING ANNUAL INVESTMENT EXPENSE AND OPERATING COST FOR RECIRCULATION COOLING USING A FORCED-DRAFT COOLING TOWER. THE RESULTS OF A DOWNSTREAM POWERPLANT USING WARMER CONDENSER WATER THAN WOULD NATURALLY HAVE BEEN AVAILABLE ARE A DECREASE IN TOTAL ELECTRIC GENERATION AND A DECREASE IN THERMAL EFFICIENCY, HENCE, AN INCREASE IN COST PER KILOWATT HOUR. THERMAL DISCHARGE HAS THE EFFECT OF DIMINISHING DOWNSTREAM FLOWS AND LAKE VOLUMES JUST AS DOES RECIRCULATION COOLING TO AVOID THERMAL DISCHARGE. (W71-04733).

00464. REGIONAL TRADE AND STRUCTURE MODEL FOR POLLUTION ABATEMENT STUDY.

STILLSON, R.T.
SYSTEMS ANALYSIS FOR GREAT LAKES WATER RESOURCES, P 75-89, OCTOBER 1969. 15 P.

OUTLINES OF A REGIONAL TRADE MODEL USEFUL IN DETERMINING THE LIKELY ECONOMIC IMPACT OF VARIOUS PROPOSED POLLUTION ABATEMENT PROGRAMS FOR THE WESTERN BASIN OF LAKE ERIE WERE PRESENTED. THE MODEL WAS DESIGNED TO ANALYZE THE LIKELY ECONOMIC IMPACT OF IMPLEMENTATION OF 'THE LAKE ERIE REPORT: A PLAN FOR WATER POLLUTION CONTROL' WHICH PROPOSED SEVERAL ABATEMENT PROGRAMS INCLUDING CONSTRUCTION FOR SEWERS, SECONDARY AND TERTIARY TREATMENT FACILITIES OF MUNICIPAL WASTE AND ENFORCEMENT OF A HIGH STANDARD OF INDUSTRIAL TREATMENT FACILITIES. INTERREGIONAL ACTIVITY ANALYSIS WAS BROKEN DOWN FOR EACH REGION INTO: (1) PRODUCTION OF FINAL PRODUCTS, (2) PRODUCTION OF INTERMEDIATE PRODUCTS AND (3) SHIPMENT OF EVERY COMMODITY FROM EACH REGION. A SAMPLE INPUT-OUTPUT MATRIX OF SUCH ACTIVITIES WAS SHOWN. THIS ACTIVITY ANALYSIS WAS USED TO FORMULATE A PROGRAMMING MODEL TO ALLOCATE GIVEN RESOURCES AMONG ACTIVITIES. THE VARIABLE MAXIMIZED WAS THE GROSS RETURN TO REGIONAL RESOURCES AND TO SHIPPING. THE FOUR CONSTRAINTS ON THE ACTIVITY LEVELS WERE: (1) MATERIAL BALANCES, (2) FINAL RESOURCE CONSTRAINTS, (3) CAPACITY CONSTRAINTS, AND (4) NON-NEGATIVITY CONSTRAINTS. THE MODEL WAS USED TO SIMULATE SHORT RUN IMPACT OF ABATEMENT PROGRAMS WITH FOUR MAJOR EFFECTS ON A REGIONAL ECONOMY: (1) TAXATION EFFECT, (2) WATER INPUT EFFECT, (3) INDUSTRIAL CONTROL EFFECT, AND(4) ABATEMENT AS A USER OF RESOURCES. THE MODEL WAS TO BE SIMULATED FOR THE DETROIT-TOLEDO AREA USING INPUT-OUTPUT COEFFICIENTS FOR 1963. (W71-04763).

00465. COMBINED SEWER TEMPORARY UNDERWATER STORAGE FACILITY.

WATER POLLUTION CONTROL RESEARCH SERIES 11022 DPP 10/70, OCTOBER 1970. 75 P.

A PILOT PLANT UNDERWATER STORAGE FACILITY WAS DESIGNED, CONSTRUCTED, OPERATED AND EVALUATED AS A METHOD OF TEMPORARILY STORING STORM OVERFLOW FROM THE COMBINED SEWER OF THE CHOPTANK AVENUE DRAINAGE BASIN, CAMBRIDGE, MARYLAND. COMBINED SEWAGE IN EXCESS OF THE SEWER CAPACITY, WHICH WOULD NORMALLY BE DISCHARGED DIRECTLY INTO THE CHOPTANK RIVER, WAS INTERCEPTED AND PUMPED INTO A NOMINAL 200,000 GALLON FLEXIBLE UNDERWATER STORAGE CONTAINER LOCATED 1300 FEET OFFSHORE. THE STORED OVERFLOW WAS LATER RETURNED FROM THE TANK AT A RATE WHICH COULD BE ACCOMMODATED BY THE INTERCEPTING SEWER AND TREATMENT PLANT. THE FACILITY WAS TESTED WITH OVERFLOW BOTH FROM FOUR NATURALLY OCCURRING RAINFALLS AND USING FRESH WATER SIMULATION. THE OVERFLOW SAMPLES WERE ANALYZED IN A FIELD LABORATORY FOR THE FOLLOWING CHARACTERISTICS: PH, SUSPENDED SOLIDS, VOLATILE SUSPENDED SOLIDS, SETTLEABLE SOLIDS, 5 DAY BIOCHEMICAL OXYGEN DEMAND, AND CHEMICAL OXYGEN DEMAND. THE PILOT PLANT FACILITY WAS CAPABLE OF COLLECTING 96 PERCENT OF THE AVERAGE ANNUAL OVERFLOW FROM THE DRAINAGE BASIN AT A COST OF LESS THAN $1.85 PER THOUSAND GALLONS. THE FACILITY COULD PREVENT THE ANNUAL DISCHARGE OF 7,136 POUNDS BOD INTO THE CHOPTANK RIVER. UNDERWATER STORAGE FACILITIES COULD BE USED EFFECTIVELY FOR A NUMBER OF COMBINED SEWER AREAS. SITE SELECTION, HOWEVER, HAS BEEN PROVEN TO BE A CRITICAL FACTOR. CARE MUST BE EXERCISED TO PREVENT PUBLIC DISTURBANCE, AND FACTORS SUCH AS LAND USE, TIDAL CONDITIONS, OR THE TYPES OF STORMS, MUST ALSO BE CONSIDERED. (PB-197 669) (W71-04668).

00466. WATER REUSE SYSTEMS ANALYSIS.

BISHOP, A.B.; HENDRICKS, D.W.
JOURNAL OF THE SANITARY ENGINEERING DIVISION, ASCE, 97(SA1) 41-57, 1971.

A SYSTEMS APPROACH FOR ANALYZING WATER REUSE ALTERNATIVES WAS DEVELOPED FOR SEQUENTIAL AND RECYCLED WATER REUSE WHICH DELINEATED OPTIMAL ALLOCATIONS FROM EACH SUPPLY CATEGORY TO EACH

USE SECTOR OF AN ORIGIN-DESTINATION MATRIX FOR MINIMIZATION OF COSTS. THREE LEVELS OF TREATMENT WERE INCLUDED: (1) CONVENTIONAL PRIMARY-SECONDARY; (2) TERTIARY; AND (3) DESALTING. A CLASSICAL TRANSPORTATION ALGORITHM, USING LINEAR PROGRAMMING WAS ADAPTED TO INCLUDE UNIT COST OF DELIVERING WATER HAVING A SPECIFIED QUALITY FROM EACH ORIGIN TO EACH DESTINATION. TREATMENT COST, AS WELL AS THE TRANSPORT COST, WAS INCLUDED. A CASE STUDY OF THE AGRO-URBAN-INDUSTRIAL REGION OF THE SALT LAKE CITY AREA DEMONSTRATED AN APPLICATION OF THE MODEL TO A SPECIFIC METROPOLITAN AREA. LEAST COST RESULTS FOR LEVELS OF DEMAND FOR THE YEARS 1965, 1980, 2000, AND 2020 SHOWED A CHANGING PATTERN OF ALLOCATION. THE MODEL SHOWED THAT FOR 1965, SURFACE AND GROUNDWATER SUPPLIES WERE SENT DIRECTLY TO USER DESTINATIONS, WITH EFFLUENTS TO SYSTEM OUTFLOW; BY 1980 TERTIARY TREATMENT ENTERS THE PICTURE; AND BY 2020 DESALTING, AND SURFACE AND GROUNWATER BLENDING WITH OUTPUT FROM TERTIARY TREATMENT AND DESALTING PLANTS BECOME IMPORTANT. (W71-04778).

00467. THE COLLECTION OF MANURE FROM HOUSED LIVESTOCK.

FORSYTH, R.J.

JOURNAL AND PROCEEDINGS OF THE INSTITUTION OF AGRICULTURAL ENGINEERS, VOL 21, P 129-133, 1965.

THE PAPER DESCRIBES COLLECTION AND HANDLING METHODS FOR DAIRY MANURE IN SCOTLAND. PARLOR SYSTEMS ARE SCARCE BECAUSE OF THEIR LARGE BEDDING REQUIREMENT. SLATTED FLOORS IN CONJUNCTION WITH FREE HOUSING SYSTEMS HAS PROVEN HIGHLY SATISFACTORY. DIFFERENT SLAT TYPES ARE DISCUSSED AND EVALUATED. UNDER SLAT TANKS OR CHANNELS ARE DESCRIBED AS WELL AS CRITERIA FOR DILUTION, STORAGE CAPACITY, AND SLUICE GATES. THE POSSIBILITY OF USING THE PASVEER OXIDATION DITCH IS INTRODUCED AS A RESULT OF STRINGENT POLLUTION REGULATION. DESIGN AND COSTS FOR THE OXIDATION DITCH ARE PRESENTED. A DISCUSSION FOLLOWS THE PAPER. (W71-04917).

00468. AEROBIC PURIFICATION OF FARM WASTE.

SCHELTINGA, H.M.J.

JOURNAL PROCEEDINGS OF THE INSTITUTION OF SEWAGE PURIFICATION, P 585-588. 1966.

MODEL TESTS, LABORATORY INVESTIGATIONS, AND FINALLY A FULL SCALE FIELD EXPERIMENT WITH OXIDATION DITCHES WERE CARRIED OUT IN HOLLAND, WHERE AN EFFECTIVE AND ECONOMICAL WASTE TREATMENT SYSTEM IS BEING SOUGHT. A 50 PERCENT BOD REDUCTION WAS OBTAINED USING ANAEROBIC DECOMPOSITION IN THE LABORATORY. INITIAL AND FINAL CHARACTERISTICS OF THE PIG WASTE ARE GIVEN BEFORE AND AFTER TREATMENT IN THE OXIDATION DITCH. FOAMING WAS EXCESSIVE FROM THE START. NITRIFICATION PLAYED AN IMPORTANT PART IN ELIMINATING THE AMMONIA. TOTAL AND EXPECTED OPERATIONAL COSTS ARE GIVEN. (W71-04920).

00469. NEW DEVELOPMENTS IN THE TREATMENT OF METAL FINISHING WASTES BY ION EXCHANGE OF RINSE WATERS.

VON AMMON, F.K.

PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 22ND, MAY 2, 3, 4, 1967, PURDUE UNIVERSITY, 42(3), 788-799, 1968.

THE ADVANTAGES AND PROBLEMS OF ION EXCHANGE AND RECIRCULATION ARE DISCUSSED FROM THE EXPERIENCES OF THREE NEW PLANTS IN GERMANY. THE TYPE AND SITUATION OF THE PLANTS, COLLECTION OF RINSE WATERS, THE DESIGN AND OPERATION OF THE ION EXCHANGE PROCESS, THE PROPERTIES OF THE CIRCULATED WATER, THE WASTE WATER TREATMENT, THE PROPERTIES OF FINAL EFFLUENT, AND ECONOMIC CONSIDERATIONS ARE DISCUSSED. RECIRCULATION WAS FOUND TO BE MORE ECONOMICAL UNLESS COSTS FOR WATER SUPPLY ARE EXTREMELY LOW OR NO WASTE TREATMENT IS REQUIRED. RECIRCULATION RESULTS IN THE REDUCTION IN WASTE QUANTITY WHICH GIVES OBVIOUS ADVANTAGES FOR REDUCED WASTE TREATMENT AND A LOWER POLLUTION LOAD ON RECEIVING WATERS. (W71-05002).

00470. TREATMENT AND DISPOSAL OF EFFLUENT FROM A 450 TON PER DAY KRAFT PULP AND PAPER MILL INTO CLASSIFIED INLAND WATERS.

VICKERMAN, J.L.

PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 22ND, MAY 2, 3, 4, 1967, PURDUE UNIVERSITY, 52(3), 968-982, 1968.

ALTHOUGH THE KINLEITH MILL SUFFERS FROM THE DISADVANTAGE OF DISCHARGING INTO NEW ZEALAND'S LONGEST AND MOST UTILIZED INLAND WATERWAY, IT IS ENDOWED WITH TWONATURAL ADVANTAGES: (1) A CONSIDERABLE POTENTIAL FOR PURIFICATION INHERENT IN THE 360 FT. FALL OF THE EFFLUENT STREAM TO THE WAIKATO RIVER; AND (2) A TOPOGRAPHY AND SOIL SUITED TO A GOOD VOLUME OF SEEPAGE DISPOSAL. TO TREAT THIS EFFLUENT THEY HAVE CONSTRUCTED TWO SEWER SYSTEMS: (1) THE STRONGER EFFLUENTS GRAVITATE FROM THE MILL SITE THROUGH AN OPEN CHANNEL FOR OVER A MILE WHERE THEY ENTER A SEDIMENTATION POND INTO A SEEPAGE PIT, AND THEN INTO A POND FOR RETENTION AND CONTROLLED DISCHARGE ON A SEASONAL CYCLE; AND (2) A SYSTEM THAT FLOWS THROUGH A PRIMARY CLARIFIER LOCATED ADJACENT TO THE MILL AND THEN DISCHARGES TO A STREAM COURSE WHICH EVENTUALLY FLOWS TO MARETAI LAKE AND CLASSIFIED WATERS. THE OPERATING COST PER TON OF PULP IS ABOUT 68 CENTS WHILE THE UNIT CAPITAL COST PER ANNUAL TON OF PULP IS $4.23. (W71-05011).

00471. USE OF STYROFOAM FOR TRICKLING FILTER COVERS.

SHEAHAN, J.P.

PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 20TH, MAY 4, 5, 6, 1965, PURDUE UNIVERSITY, 49(4), 572-582, 1965.

A COMPARISON OF THE EFFICIENCIES OF COVERED VERSUS UNCOVERED TRICKLING FILTERS WAS MADE BY THE DOW CHEMICAL COMPANY. IT WAS FOUND THAT THERE WAS SOME INCREASE IN EFFICIENCY BUT NOT ENOUGH TO JUSTIFY COVERING THE TRICKLING FILTERS. OTHER ADVANTAGES TO COVERING TRICKLING FILTERS ARE PREVENTION OF FREEZING, ODOR CONTROL, FOG CONTROL, LESSENING THE SPREAD OF FILTER FLIES, AND IM-

PROVED APPEARANCE. THE MAIN DISADVANTAGE OF COVERING A TRICKLING FILTER IS THE EXCESSIVE COST WHICH IS IN THE RANGE OF $2.75-5.00 PER SQUARE FOOT OF PLAN AREA. (W71-05025).

00472. THE COMBINED TREATMENT OF PETROCHEMICAL WASTES, GASIFICATION WASTES, AND FISCHER-TROPSCH SYNTHESIS WASTES.

LOEWENSTEIN, P.R.; DE WAAL, W.P.
PROCEEDINGS INDUSTRIAL WASTE CONFERENCE, 21ST, MAY 2, 4, 5, 1966, PURDUE UNIVERSITY, 50(2), 480-494, 1966.

SEGREGATION OF STORM WATER AND SPENT COOLING WATER FROM OIL POLLUTED WASTE STREAMS HAS SIGNIFICANTLY REDUCED TREATMENT COSTS AND INCREASED PLANT EFFICIENCY FOR A SOUTH AFRICAN PETROCHEMICAL PLANT. THE ADDITION OF FLOCCULATION FACILITIES HAS GREATLY ENHANCED TREATMENT EFFICIENCY IN THE CASE OF OIL AND LATEX POLLUTED WATERS. A COMPLETE DESCRIPTION OF THE GEOGRAPHICAL LOCATION OF SEWER SYSTEMS, PRIMARY AND SECONDARY TREATMENT FACILITIES, AND EFFLUENT DISCHARGE CONSTRAINTS IS PRESENTED. AT PRESENT, THIS COMPLEX IS OPERATING WITHIN OR NEARLY WITHIN THE GOVERNMENTAL CONSTRAINTS, BUT INCREASINGLY HIGHER EFFLUENT QUALITY STANDARDS MAY SOON NECESSITATE FURTHER UPDATING OF, AND ADDITION TO THE TREATMENT FACILITIES (W71-05032).

00473. SODIUM HYDROXIDE RECOVERY IN THE TEXTILE INDUSTRY.

CARRIQUE, C.S.; JAUREGUI, L.U.
PROCEEDINGS INDUSTRIAL WASTE CONFERENCE, 21ST, MAY 3, 4, 5, 1966 PURDUE UNIVERSITY, 50(2), 861-868, 1966.

HIGH TREATMENT COSTS FOR SODIUM HYDROXIDE EFFLUENTS, AND HIGH REPLACEMENT COSTS FOR SODIUM HYDROXIDE ITSELF NECESSITATED CONSTRUCTION OF A SYSTEM TO SEGREGATE THE SODIUM HYDROXIDE WASTE STREAM AND RECLAIM THE SODIUM HYDROXIDE. THIS DECISION WAS MADE BY AN ARGENTINE TEXTILE MILL, AND IT RESULTED IN DECREASED CHEMICAL COSTS BOTH FOR ALUM COAGULATION AND NEUTRALIZATION, AND IT WAS MORE ECONOMICAL TO RECLAIM THE SODIUM HYDROXIDE THAN TO REPLACE IT. THE TOTAL NET GAIN IS APPROXIMATELY 35 TO 40 THOUSAND U. S. DOLLARS PER YEAR FOR A FIRM HANDLING ABOUT 2000 METRIC TONS OF COTTON PER YEAR. THE SYSTEM DEVISED CONSISTS OF EVAPORATIVE CONCENTRATION COMBINED WITH FILTRATION. PROBLEMS WERE ENCOUNTERED IN THE ORIGINAL SINGLE EFFECT SYSTEM BECAUSE THE RECOVERED PRODUCT HAD A STRONG COLOR AND COULD NOT BE USED FOR RECYCLING. ALSO, THE USE OF CAUSTIC SODA IN THE PLANT OCCASIONED MANY CORROSION PROBLEMS. THE ADDITION OF A SECOND EVAPORATOR, WORKING UNDER A VACUUM, MADE THE PROCESS A DOUBLE EFFECT EVAPORATOR, AND PROVIDED BOTH MORE COMPLETE AND MORE EFFICIENT TREATMENT OF THE CAUSTIC SODA SOLUTION. THIS UNIT PROVIDED REUSE OF HEAT FROM THE SINGLE EFFECT EVAPORATOR, PERMITTED THE COLLECTION OF SODIUM HYDROXIDE FREE OF COLOR, AND AVOIDED THE SERIOUS CORROSION PROBLEMS. (W71-05034).

00474. THERMOELECTRIC GENERATORS POWERED BY THERMAL WASTE FROM ELECTRIC POWER PLANTS.

SHIRAZI, M.A.
FEDERAL WATER QUALITY ADMINISTRATION, WATER POLLUTION CONTROL RESEARCH SERIES 16130, SEPTEMBER, 1970 PRESENTED AT THE IECEC ENERGY 70 CONFERENCE, LAS VEGAS, NEVADA, SEPT, 1970, P 27.

A CROSSFLOW TYPE HEAT EXCHANGER WITH THE PLATE FIN SURFACE GEOMETRY IS DESCRIBED. THE PLATE SEPARATING THE HOT FLUID FROM THE COLD FLUID CONTAINS THE THERMOELECTRIC UNIT. EQUATIONS FOR CALCULATING CONVECTIVE HEAT TRANSFER COEFFICIENTS, THE FRICTION POWER EXTENDED PER UNIT SURFACE AREA AND THE MAXIMUM CONVERSION EFFICIENCY ARE DESCRIBED. THE ALLOYS CONSIDERED IN THIS STUDY WERE BI2TE3 - BI2SE3 (N TYPE) AND BI2TE3 - SB2TE3 (P TYPE). WHILE CONDUCTING THE LATENT HEAT FROM THE CONDENSING STEAM TO THE COOLING WATER, THE COUPLES CONVERT A PORTION OF THIS HEAT TO ELECTRICITY. A SECOND SOURCE OF WASTE HEAT IN A CONVENTIONAL FOSSIL-FUELED ELECTRIC POWERPLANT IS THE HOT STACK GASES RELEASED INTO THE ATMOSPHERE. ANOTHER SOURCE IS HOT EXHAUST GASES FROM A GAS TURBINE ELECTRIC POWER SYSTEM. CONDENSER PERFORMANCE DATA ARE PRESENTED IN THREE SEPARATE TABLES. POWER GENERATED INCREASES WITH TURBINE BACK PRESSURE. A CAPITAL COST ESTIMATE FOR THREE PLATE MODULE THICKNESS OF 0.01, 0.02 AND 0.05 INCH ARE ESTIMATED AT $1250, $1560 AND $3720 PER KW, RESPECTIVELY. RATIO OF THE COST OF THERMOELECTRIC TO STREAM ELECTRIC GENERATION INCREASED WITH PLATE THICKNESS AND IS AS HIGH AS 14 FOR A PLATE THICKNESS OF 0.05 INCH. IT IS UNECONOMICAL, AT THE PRESENT TIME, TO USE THERMOELECTRIC DEVICES TO GENERATE ELECTRICITY FROM WASTE HEAT. (W71-05121).

00475. ULTRAFILTRATIVE DEWATERING OF SPENT POWDERED CARBON.

DESAULNIERS, C.W.; HAUSSLEIN, R.W.
WATER POLLUTION CONTROL RESEARCH SERIES, ORD 17020 DBA 03/70, MARCH 1970. 68 P.

SPENT POWDERED ACTIVATED CARBON FROM SECONDARY EFFLUENT TREATMENT HAS BEEN SUCCESSFULLY DEWATERED BY CONTINUOUS MEMBRANE ULTRAFILTRATION. 5 AND 10% CARBON SOLIDS CONCENTRATION SLURRIES, USING A LABORATORY SIZE THIN CHANNEL (0.1 SQ FT MEMBRANE AREA), HAVE BEEN DEWATERED BY CONTINUOUS ULTRAFILTRATION TO SOLIDS LEVELS OF 25 TO 30%. DEWATERING RATES RANGED BETWEEN 50 AND 100 GAL/SQ FT PER DAY TRANSMEMBRANE PRESSURES OF FROM 10 TO 50 PSI DURING RUNS AS LONG AS 9 DAYS, AND PRODUCT WATER WAS INVARIABLY FREE OF ANY SUSPENDED CARBON SOLIDS. THE COST OF MEMBRANE ULTRAFILTRATION DEPENDS UPON THE MEMBRANE LIFE, AND AT MEMBRANE FLUX RATES OF 50 GAL/SQ FT PER DAY THE COST OF DEWATERING CARBON FROM 10 TO 20% SOLIDS IS $0.0015 PER POUND OF CARBON WITH A MEMBRANE LIFE OF SIX MONTHS, AND $0.0035 PER POUND WITH A MEMBRANE LIFE OF ONLY ONE MONTH. AT THE PRESENT NO CONCLUSIVE DATA ON MEMBRANE LIFE IS AVAILABLE, BUT ESTIMATES OF BETWEEN 1 AND 6 MONTHS ARE QUITE COMMON AND SEEM TO BE REASONABLE. (PB-197 865) (W71-05158).

00476. EXTENDED AERATION ACTIVATED SLUDGE TREATMENT OF PETROCHEMICAL WASTE.

PRUESSNER, R.D., MANCINI, J.
PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 21ST, MAY 3, 4, 5, 1966, PURDUE UNIVERSITY, 50(2), 591-599, 1966.

LABORATORY UNITS CONSISTING OF CONTINUOUS FLOW ACTIVATED SLUDGE UNITS TO PROVIDE A RAPID EVALUATION OF GROSS LOADING AND TOXICITY INFORMATION, AND BATCH TEMPERATURE STUDIES WERE CONDUCTED. TWO PILOT PLANTS CONSISTING OF A CONVENTIONAL ACTIVATED SLUDGE AND AN EXTENDED AERATION ACTIVATED SLUDGE UNIT WERE ALSO OPERATED TO PROVIDE A BASIS FOR OUR FINAL WASTE TREATMENT PLANT DESIGN. THE EXTENDED AERATION ACTIVATED SLUDGE TREATMENT UNIT PROVED TO BE THE MOST EFFICIENT AND REMOVES ABOUT 99% OF THE BOD FROM THE WASTE STREAM IN A STABLE SYSTEM WHICH REQUIRES ABOUT 3 HOURS PER DAY OPERATOR TIME. IT WAS ALSO FOUND THAT THE USE OF AN ANAEROBIC POND IS AN ECONOMICAL METHOD OF SLUDGE DISPOSAL. (W71-05167).

00477. CENTRIFUGAL DEWATERING OF PRIMARY PAPER INDUSTRY SLUDGES.

BLOSSER, R.O., CARON, A.L.
PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 21ST, MAY 3, 4, 5, 1966, ENGINEERING BULLETIN OF PURDUE UNIVERSITY, 50(2), 450-456, 1966.

EXTENSIVE PILOT PLANT WORK AND FIELD INSTALLATIONS HAVE REVEALED SOME OF THE FACTORS WHICH AFFECT THE EFFICIENCY OF SLUDGE DEWATERING SUCH AS (1) BOWL SPEED, (2) DETENTION TIME IN THE BOWL, AND (3) FEED SLUDGE CONSISTENCY. THE ADVANTAGES OF THE EQUIPMENT DESCRIBED ARE (1) IT REQUIRED LITTLE SUPERVISION, (2) IT IS CAPABLE OF HANDLING WIDE VARIATIONS IN FEED SLUDGE CONSISTENCY, (3) HAS A LOW SPACE REQUIREMENT, (4) IT ELIMINATES THE NEED FOR CHEMICAL CONDITIONING, AND (5) THE COSTS ARE COMPETITIVE WITH VACUUM FILTRATION. LIMITATIONS OBSERVED WERE THAT TRASH IN THE FORM OF CHIPS AND STICKS CANNOT BE HANDLED AND FLOW RATES MUST BE HELD AT A LOW LEVEL ON GPM TO HORSEPOWER RATIO TO OBTAIN SATISFACTORY SOLIDS RECOVERY. (W71-05178).

00478. WATER QUALITY, THE STATE OF THE ART.

DIRASIAN, H.
URBAN AFFAIRS, 6(2), 199-212, 1970.

THE PROBLEMS OF WATER POLLUTION CONTROL AND SOLID WASTE DISPOSAL ARE CONSIDERED. AN ANALYSIS OF THE TECHNOLOGY OF PRIMARY AND SECONDARY WASTE WATER TREATMENT IS GIVEN WITH THE MAIN IMPACT OF SECONDARY TREATMENT BEING ON THE FURTHER REDUCTION OF BIOCHEMICAL OXYGEN DEMAND (BOD) OF THE WASTE WATER. TECHNIQUES FOR TERTIARY TREATMENT ARE DESCRIBED WITH STRESS ON FILTRATION TECHNIQUES AND ELECTRICAL PROCESSES. THE AUTHOR COMPARES SOLID WASTE DISPOSAL AND WASTE WATER TREATMENT AND SUGGESTS SOLID WASTE RECYCLING CAN BE PROFITABLE WHILE WASTE WATER TREATMENT COSTS ARE A MUNICIPAL BURDEN. WATER QUALITY STANDARDS ESTABLISHED BY THE STATE OF MICHIGAN WATER RESOURCES COMMISSION ARE DISCUSSED BY THE AUTHOR TO ILLUSTRATE THE RELATION BETWEEN USES OF STREAMS AND THE AMOUNT OF CONTAMINANTS ALLOWABLE FOR WATER SUPPLY, RECREATIONAL, AGRICULTURAL, AND COMMERCIAL PURPOSES. THE AUTHOR FINDS WASTE WATER TREATMENT PROBLEMS ARE NO LONGER OF A TECHNICAL NATURE BUT DUE MAINLY TO INSUFFICIENT COST ALLOCATION BY MUNICIPALITIES AND INDUSTRIAL PLANTS. (W71-05212).

00479. FLOTATION OF OILY WASTES.

QUIGLEY, R.E., HOFFMAN, E.L.
PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 21ST, MAY 3, 4, 5, 1966, ENGINEERING BULLETIN OF PURDUE UNIVERSITY, 50(2) 527-533, 1966.

A GENERAL DISCUSSION OF THE THEORY OF PRIMARY SEPARATION, AIR FLOTATION, AND FLOCCULATION OF OILY WASTES IS CONDUCTED. THE WASTE WATER SYSTEM IN USE AT THE TRENTON REFINERY IS DESCRIBED ALONG WITH THE RESULTS OF OPERATION. FLOCCULATION INCREASES THE EFFICIENCY OF THE FLOTATION PROCESS AND ALUM OR LIME HAVE GIVEN SIGNIFICANT IMPROVEMENTS IN THE OIL-WATER SEPARATION PROCESS. THE OPERATING COSTS OF THE WASTE WATER SYSTEM HAVE VARIED BUT A TYPCIAL COST WOULD BE ABOUT 11.5 CENTS PER 1000 GALLONS. (W71-05265).

00480. THE CONTROL OF ACID MINE DRAINAGE POLLUTION BY BIOCHEMICAL OXIDATION AND LIMESTONE NEUTRALIZATION TREATMENT.

GLOVER, H.G.
PROCEEDINGS, INDUSTRIAL WASTE CONFERENC, E 22ND, MAY 2, 3, 4, 1966. PURDUE UNIVERSITY, 52(2), 1968.

A NEW PROCESS FOR THE PURIFICATION OF ACID DRAINAGE FROM COAL MINING OPERATIONS IS DESCRIBED. NOVEL FEATURES INCLUDE THE BIOCHEMICAL OXIDATION OF FERROUS SALTS IN ACID SOLUTION AND THE APPLICATION OF MECHANICAL ATTRITION TO LIMESTONE GRIT WHICH IS USED FOR THE CHEMICAL NEUTRALIZATION OF THE OXIDIZED DRAINAGE. THE NEW PROCESS WILL BE MOST APPLICABLE TO THE MORE DILUTE ACID DRAINAGES FOR WHICH THE CONVENTIONAL LIME PROCESS IS LESS SUITABLE, AND COSTS OF THE NEW PROCESS ARE EXPECTED TO BE APPRECIABLY LESS THAN THE COSTS OF THE LIME PROCESS. (W71-05274).

00481. LIMITED OIL SPILLS IN HARBOR AREAS.

DORRLER, J.S.
PREVENTION AND CONTROL OF OIL SPILLS, JOINT CONFERENCE, PROCEEDINGS, NEW YORK, NEW YORK, DECEMBER 15-17, 1969, CO-SPONSORED BY AMERICAN PETROLEUM INSTITUTE AND U.S. FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D.C., AMERICAN PETROLEUM INSTITUTE PUBLICATION NO 4040, P 151-156.

LIMITED OIL SPILLS ARE NUMEROUS AND OCCUR FREQUENTLY. THEY REQUIRE PROPER TREATMENT, AND ARE EXPENSIVE TO TREAT. THE PHYSICAL CONDITIONS AFFECTING AN OIL SPILL, THE TYPE OF EQUIPMENT USED, AND THE EXTENT OF THE REMOVAL OPERATIONS ARE CONTRIBUTING FACTORS TO THE HIGH COST OF CLEANING UP LIMITED OIL SPILLS. AT THE TIME OF THE WRITING OF THIS PAPER THE TYPICAL LIMITED OIL SPILL COSTS THE NAVY OVER $1,000 TO CLEAN UP. THIS COST WILL INCREASE AS CONTROL AGENCIES OF HARBOR WATER QUALITY REQUIRE MORE COMPLETE REMOVAL AND CLEANUP. (W71-05333).

REFERENCE LIST

00482. FERTILIZATION OF ANNUAL RANGELAND WITH CHICKEN MANURE.

MCKELL, C.M.; BROWN, V.W.; ADOLPH, R.H.; DUNCAN, D.
JOURNAL OF RANGE MANAGEMENT, 23, P 336-340, 1970.

WHERE ANNUAL RANGELANDS ARE CLOSE TO THE SOURCE OF SUPPLY, FERTILIZATION WITH CHICKEN MANURE APPEARS TO HOLD CONSIDERABLE PROMISE IN IMPROVING THE PRODUCTION OF FORAGE FOR GRAZING. FERTILIZED PLOTS WERE READY TO BE USED EARLIER IN FORAGE OF A HIGHER QUALITY AND PALATABILITY. PROTEIN AND PHOSPHORUS WERE SIGNIFICANTLY HIGHER IN FORAGE FROM FERTILIZED PLOTS. FERTILIZER VALUE OF CHICKEN MANURE IS EQUAL TO EQUIVALENT RATES OF COMMERCIAL FERTILIZER. THERE APPEARS TO BE A SLOWER RELEASE OF FERTILIZER ELEMENTS FROM CHICKEN MANURE THAN FROM INORGANIC FERTILIZER. ANNUAL FORAGE LEGUMES DO NOT APPEAR TO BENEFIT INITIALLY FROM THE APPLICATION OF CHICKEN MANURE. IN SUBSEQUENT YEARS FOLLOWING FERTILIZATION, THE LEGUMES APPEAR TO THRIVE ON THE INCREASED LEVEL OF AVAILABLE PHOSPHORUS. IT WAS PROFITABLE FOR RANGELAND OPERATORS TO FERTILIZE WITH POULTRY MANURE PROVIDED THEY COULD GET IT FOR $3.10 TO $4.35 PER TON APPLIED. AN AVERAGE OF 1,600 POUNDS OF EXTRA FEED WAS OBTAINED FOR EACH TON OF MANURE. (W71-05419).

00483. WHIPPING THE MANURE PROBLEM.

LINN, A.
FARM QUARTERLY, WINTER 1966-1967, P 56-59, 115-116.

THE OXIDATION DITCH IS DESCRIBED AS AN IMPORTANT NEW BREAKTHROUGH IN MANURE HANDLING. ADVANTAGES OF THE OXIDATION DITCH INCLUDE SAVINGS IN LABOR, HANDLING MANURE AS A LIQUID, ELIMINATION OF ALMOST ALL ODOR, AND THE PRESERVATION AND CONCENTRATION OF FERTILIZER NUTRIENTS. BASIC DESIGN STANDARDS ARE GIVEN FOR THE DITCH AND PADDLE WHEEL. IF THE DITCH IS MANAGED ON A CONTINUOUS BASIS, 1 1/2 PERCENT OF THE DITCH VOLUME CAN BE ADDED AS MANURE DAILY. GENERAL MANAGEMENT REQUIREMENTS AND COSTS ARE INCLUDED. THE PADDLE WHEEL WITH A 1 1/2 TO 3 HP MOTOR COSTS ABOUT $600. THE DITCH WALLS CAN BE INCORPORATED INTO THE BUILDING'S FOUNDATION. ESTIMATED POWER COSTS ARE ABOUT $1.00 PER HOG AND $8.20 PER 1000 POUND DAIRY COW PER YEAR. MANY CHANGES IN CONFINED LIVESTOCK PRODUCTION THROUGH USE OF THE OXIDATION DITCH ARE CONTEMPLATED. (W71-05422).

00484. HOW WE HANDLE LIQUID MANURE.

HOARD'S DAIRYMAN, VOL 109, P 1251-1255, 1280-1281, 1965.

FIVE TOP DAIRYMEN ARE INTERVIEWED ABOUT THEIR LIQUID MANURE HANDLING SYSTEMS. ALL INCORPORATED STORAGE TANKS, AND DISPOSAL ON LAND WITH TANK SPREADERS. DIFFERENT TYPES OF AGITATION AND PUMPING METHODS ARE EXPLAINED. THE SYSTEMS RANGED IN COST FROM $3250 TO $7800, OR FROM $35 TO $52 PER COW. THIS INCLUDED STORAGE TANK, AGITATION AND PUMPING EQUIPMENT, AND TANK SPREADERS. SEVERAL SPENT UP TO $6600 FOR CONCRETING THE BARNYARDS. THE TANKS VARIED IN CAPACITY FROM 18,000 TO 75,000 GALLONS, AND WERE EMPTIED AS OFTEN AS ONCE A WEEK TO ONCE EVERY TWO MONTHS. THE NEED FOR ADDED MOISTURE IS DISCUSSED AS WELL AS FLY AND ODOR PROBLEMS. SOME DISADVANTAGES ARE GIVEN, THE MAJOR ONE BEING THE HIGH CAPITAL INVESTMENT. (W71-05426).

00485. WASTES FROM PIG PRODUCTION UNITS.

PONTIN, R.A.; BAXTER, S.H.
WATER POLLUTION CONTROL, 67(6), 632-638, 1968.

METHODS FOR THE DISPOSAL OR TREATMENT OF THE INCREASING QUANTITIES OF SLURRY FROM INTENSIVE PIG PRODUCTION UNITS ARE OUTLINED. THE POSSIBLE APPLICATION OF THE OXIDATION DITCH FOR SUCH TREATMENT IS DISCUSSED AND THE RESULTS OF EXPERIMENTS OF A COMMERCIAL PIGGERY ARE DESCRIBED. THE AUTHORS CONCLUDE THAT THE METHOD OFFERS THE PROMISE OF AN ECONOMIC SOLUTION BUT THAT FURTHER RESEARCH IS URGENTLY NEEDED. (W71-05428).

00486. MECHANICAL CLEANING OF COWSHEDS.

ADDISON, J.N.
AGRICULTURE, 77(11), 534-536, 1970.

TWENTY-ONE COWSHEDS ON EIGHTEEN FARMS WERE SURVEYED TO ESTABLISH THE EXTENT TO WHICH MECHANICAL CHANNEL CLEANERS HAD BEEN INSTALLED, THEIR AGE, CONDITION, COSTS, AND REASONS FOR THEIR INSTALLATION IN THE FIRST PLACE. PROBLEMS WITH THE MECHANICAL CLEANERS ARE DISCUSSED AS WELL AS DESIGN SPECIFICATIONS. THE COST PER COW OF THE SHUTTLE TYPE CLEANER WAS FOUND TO BE ABOUT 21 POUNDS AND THAT OF THE CONTINUOUS TYPE 18 POUNDS. (W71-05431).

00487. MODELING AND OPTIMIZATION OF WATER QUALITY IN STREAMS.

REGE, R.S.
MASTER'S THESIS, KANSAS STATE UNIV, 1970. 123 P.

A STEADY STATE ON DIMENSIONAL DISPERSION MODEL WAS DEVELOPED TO REPRESENT THE BOD AND DO BALANCES IN A STREAM HAVING SEVERAL OUTFALLS OF WASTE AND INTAKES OF WATER. THE MODEL ALSO INCLUDED CONTINUOUS ADDITIONS AND REMOVALS OF BOD AND DO ALONG THE STREAM. IN THE PRESENTATION, A LITERATURE SURVEY WAS MADE DEALING WITH THE DEVELOPMENT OF DETERMINISTIC MODELS OF DESCRIBING WATER QUALITY IN STREAMS AND WATER QUALITY MANAGEMENT MODELS USING A DETERMINISTIC APPROACH. THEN A COMPLETE DESCRIPTION OF THE FORMULATION OF THE DISPERSION MODEL WAS GIVEN. FOR THE PURPOSE OF ANALYSIS THE STREAM WAS DIVIDED INTO SEVERAL SEGMENTS, EACH SEGMENT BEGINNING AT THE LOCATION OF A WASTE OUTFALL OR WATER INTAKE. THE SOLUTION WAS DERIVED BY APPLYING CONTINUITY EQUATIONS AT THE BOUNDARY OF EACH SEGMENT, AND EQUILIBRIUM CONDITIONS AT THE ENDS OF THE STREAM WHICH WERE ASSUMED TO BE INFINITELY LONG. THE MODEL WAS EXTENDED TO INCORPORATE WASTE TREATMENT PLANT MODELS AT THE LOCATION OF WASTE OUTFALLS, AND WATER TREATMENT PLANT MODELS AT THE INTAKES. THE OPTIMAL WASTE DISCHARGE POLICY ALONG A STREAM WAS INVESTIGATED BASED ON A PROGRAM OF MINIMIZING THE TOTAL COST BENEFIT FUNCTION. THE FEASIBILITY OF OBTAINING A SOLUTION BY A SEARCH TECHNIQUE CAPABLE OF HANDLING NONLINEAR CONSTRAINTS ON WATER QUALITY WAS STUDIED. APPLICATION TO A HYPOTHETICAL STREAM AND MODEL USE IN FUTURE RESEARCH WERE DISCUSSED. (W71-05684).

COST ANALYSIS OF WATER POLLUTION CONTROL

00488. ORIGINS AND NATURE OF FARM WASTES.

JONES, K.B.C.; RILEY, C.T.
PROCEEDINGS OF SYMPOSIUM: FARM WASTES: THE INSTITUTE OF WATER POLLUTION CONTROL AND THE UNIVERSITY OF NEWCASTLE UPON TYNE, PAPER NO 1, P 7-14, 1970.

WASTE DISPOSAL IS DISCUSSED IN RELATION TO POPULATION EXPANSION, DIMINISHING ACRES, DECLINING NUMBERS OF AGRICULTURE WORKERS, ECONOMIC PRESSURES, LIMITED NATURAL WATER RESOURCES, AND LEGAL PRESSURES. THE ORIGIN AND NATURE OF THE WASTESTHAT MUST BE DISPOSED OF IS DISCUSSED. THE TRENDS IN PLANNING AND DISPOSAL PATTERNS TAKING PLACE WERE CONSIDERED. THE COSTS ASSOCIATED WITH DISPOSAL WERE EXAMINED IN RELATION TO THE INCOME PRODUCED. FOOD PROCESSING WASTE HAS CREATED SOME DISPOSAL PROBLEMS FOR FARMERS. THE DISPOSAL PROBLEMS CREATED BY FRUIT AND MEAT PROCESSING ARE DISCUSSED IN THE LAST PORTION OF THE PAPER. (W71-05748).

00489. MINIMIZING THE WASTE PROBLEM WITH CATTLE.

COOPER, M.M.
PROCEEDINGS OF SYMPOSIUM: FARM WASTES: THE INSTITUTE OF WATER POLLUTION CONTROL AND THE UNIVERSITY OF NEWCASTLE UPON TYNE. PAPER NO 11, 81-83, 1970.

THIS PAPER DISCUSSES SOME OF THE CHANGES TAKING PLACE IN THE CATTLE INDUSTRY AND THE REQUIREMENTS FOR WASTE DISPOSAL. MANY CATTLE PRODUCERS REQUIRE CONFINEMENT AREAS FOR CATTLE FOR AT LEAST PART OF THE YEAR. SOME OF THE SYSTEMS BEING UTILIZED FOR WASTE DISPOSAL ARE DISCUSSED. DISCUSSION OF COSTS IS ALSO INCLUDED. (W71-05758).

00490. BUILDING DESIGN.

WELLER, J.B.
PROCEEDINGS OF SYMPOSIUM: FARM WASTES: THE INSTITUTE OF WATER POLLUTION CONTROL AND THE UNIVERSITY OF NEWCASTLE UPON TYNE. PAPER NO. 12, P 84-93, 1970.

THIS PAPER DISCUSSES SOME DESIGN CRITERIA FOR ANIMAL HOUSING. THE FIRST PORTION OF THE PAPER DEALS WITH THE MANAGEMENT FACTORS THAT MUST BE CONSIDERED, SUCH AS TYPE OF MANURE, QUANTITY, DISPOSAL METHOD, BEDDING, AND COST. THE REMAINDER OF THIS PAPER EXAMINES SOME OF THE IMPLICATIONS REGARDING ACTUAL BUILDING TYPES. THERE IS A COMPREHENSIVE TABLE GIVING THE DEFINITIONS AND REQUIREMENTS FOR THE MANAGEMENT OF SLURRY AND MANURE FROM LIVESTOCK. A COST ANALYSIS OF THE VARIOUS POSSIBLE DISPOSAL SYSTEMS IS PRESENTED. (W71-05759).

00491. BUILDING DESIGN AND MANURE DISPOSAL.

GLERUM, J.C.; DE JONG, A.P.S.; POELMA, H.R
PROCEEDINGS OF SYMPOSIUM: FARM WASTES. THE INSTITUTE OF WATER POLLUTION CONTROL AND THE UNIVERSITY OF NEWCASTLE UPON TYNE. PAPER NO 13, P 94-100, 1970.

IN GENERAL, SLURRY SYSTEMS ARE PREFERABLE TO SYSTEMS FOR HANDLING SOLIDS AND URINE SEPARATELY. SPECIAL REASONS, FOR EXAMPLE DIFFICULTY IN DISPOSING OF THE MANURE, CAN CAUSE SEPARATE STORAGE TO BE USED. IF MIXED STORAGE IS USED THE LAYOUT OF THE BUILDINGS MUST BE ADAPTED TO THE SPECIFIC REQUIREMENTS OF THIS SYSTEM. ALTERING THE BUILDINGS AFTERWARDS WILL USUALLY BE VERY EXPENSIVE. THE HIGH CAPITAL COST OF THE SLURRY SYSTEM WILL OFTEN BE A DRAWBACK; THIS IS ESPECIALLY THE CASE FOR COWHOUSES WHERE A CONSIDERABLE STORAGE CAPACITY IS REQUIRED. (W71-05760).

00492. ORGANIZING WATER POLLUTION CONTROL: THE SCOPE AND STRUCTURE OF RIVER BASIN AUTHORITIES.

ROBERTS, M.J.
PUBLIC POLICY, 19(1), 75-141, 1971.

THIS PAPER EXPLORES THE ORGANIZATION OF DECISION-MAKING BY GOVERNMENTS ON WATER POLLUTION CONTROL. THE AUTHOR OUTLINES POSSIBLE CRITERIA TO EVALUATE REGIONAL INSTITUTIONS INVOLVED IN WATER QUALITY CONTROL. ONE CRITERIA CITED REQUIRES THAT AGENCIES BE OF SUFFICIENT SCALE TO CONSIDER ALL RELEVANT EXTERNALITIES. THE PROBLEM OF OPTIMAL INSTITUTIONAL CHOICE IS DISCUSSED WITH THE AUTHOR ADVOCATING A UNIFIED RIVER BASIN AGENCY. THE AGENCY WOULD LEVY SERVICE CHARGES ON INDUSTRIAL WASTE SOURCES AND HAVE SOLE POWER TO DISPOSE OF WASTE IN THE RIVER BASIN. THE CHARGES ARE SET ON THE BASIS OF THE MARGINAL COST TO THE SYSTEM OF MAINTAINING WATER QUALITY STANDARDS SET BY STATE AND FEDERAL AGENCIES. THE AUTHOR DISCUSSES FURTHER COMPLEXITIES OF REGIONAL WATER QUALITY MANAGEMENT OFTEN OMITTED FROM ECONOMIC MODELS OF OPTIMAL CHOICE. (W71-05936).

00493. WATER POLLUTION CONTROL, RIVER BASIN AUTHORITIES AND ECONOMIC INCENTIVES: SOME CURRENT POLICY ISSUES.

FREEMAN, A.M.; HAVEMAN, R.H.
PUBLIC POLICY, 19(1), 53-74, 1971.

THIS ARTICLE EXAMINES POLICY ALTERNATIVES TO THE CURRENT ENFORCEMENT-SUBSIDY APPROACH TO THE IMPROVEMENT OF WATER QUALITY. THESE PROPOSALS EMPHASIZE COMPREHENSIVE RIVER BASIN PLANNING AND WATER QUALITY MANAGEMENT AND STRESS ECONOMIC INCENTIVES, PRICES AND CHARGES, AS A MEANS OF REDUCING THE OUTPUT OF INDUSTRIAL AND MUNICIPAL WASTES. THESE PROPOSALS ARE USED TO ILLUSTRATE THE SCOPE OF THE RIVER BASIN AUTHORITY, ITS POWERS AND FUNCTIONS, THE EFFECTS OF FEDERAL COST-SHARING AND THE RIVER BASIN AUTHORITY AS A POLITICAL INSTITUTION. THE AUTHOR THEN PRESENTS HIS OWN PROPOSAL FOR THE REFORM OF FEDERAL POLICY THROUGH THE ESTABLISHMENT OF A SINGLE EXPERIMENTAL WATER BASIN AUTHORITY BASED ON THE CONSOLIDATIONS OF EXISTING AGENCIES RESPONSIBLE FOR AIR, LAND, AND WATER QUALITY IN A PARTICULAR REGION. THIS AUTHORITY WOULD MINIMIZE RELIANCE ON LEGAL ENFORCEMENT AND STRESS THE USE OF ECONOMIC INCENTIVES SUCH AS USER AND EFFLUENT CHARGES. THIS APPROACH WOULD YIELD INFORMATION ON THE EFFECTIVENESS OF THE REGIONAL APPROACH TO ENVIRONMENTAL MANAGEMENT AND THE ABILITY OF ECONOMIC INCENTIVES TO REDUCE WASTE GENERATION AT RELATIVELY LOW COST. (W71-05937).

REFERENCE LIST

00494. STEEL PIPE SELECTED FOR STORM SEWER SYSTEM.

AM CITY, 85(3), P 22, 1970.

STEEL PIPING INSTEAD OF THE MORE-COMMONLY USED REINFORCED CONCRETE WAS EMPLOYED TO CONSTRUCT A STORM SEWER SYSTEM IN LAKEWOOD, NEW YORK. ADVANTAGES OF THIS MATERIAL INCLUDE ITS STRENGTH, LIGHTER WEIGHT, AND LOWER COST. SAVINGS IN MATERIAL COST ALONE WERE ABOUT 15%, AND LOWER LABOR COSTS WERE INCURRED BECAUSE STEEL IS SIMPLER TO HANDLE THAN OTHER MATERIALS. DIMENSIONS OF THE STORM SEWER SYSTEM ARE GIVEN. (W71-06360).

00495. WATER STORAGE METHODS -- FROM CUPPED HANDS TO COMPUTERS.

LUMSDEN, T.W.
WATER POLLUTION CONTROL, 107(6), 16-19, 30, 1969.

STORAGE TANKS AND RESERVOIRS SHOULD PROVIDE FOR FLOW EQUALIZING, FIRE PROTECTION, AND EMERGENCIES. AN OVERALL SYSTEM ANALYSIS IS USUALLY NECESSARY TO DETERMINE THE MOST ECONOMICAL COMBINATION OF STORAGE FACILITY, TRUNK MAINS, AND PUMPING FACILITY. CRITERIA FOR LOCATIONS OF STORAGE FACILITIES AND CONSTRUCTION COST CONSIDERATIONS ARE NOTED IN THIS ARTICLE. STORMWATER SYSTEMS EXHAUST SIZABLE SEGMENTS OF EXPENDITURES UTILIZED FOR WATER STORAGE IN GENERAL. DRAINS MUST PROVIDE FOR NORMAL STORMWATER RUNOFF AND HIGHER FLOWS RESULTING FROM RESERVOIR EMPTYING AND INADVERTENT OVERFLOWS. (W71-0638[illegible])

00496. ECONOMIC ASPECTS.

TIMMONS, J.F.
JOURNAL PAPER NO J-6469 OF THE IOWA AGRICULTURAL AND HOME ECONOMICS EXPERIMENT STATION, IOWA STATE UNIVERSITY, AMES, IOWA, AGRICULTURAL PRACTICES AND WATER QUALITY, IOWA STATE UNIVERSITY PRESS, AMES, IOWA, 1970, CHAPTER 27, P 377-389.

THE FIRST STEP TOWARD MEETING WATER QUALITY MANAGEMENT RELATING TO WATER USEATER QUALITY PROBLEMS. THE NEED TO RECOGNIZE THE QUALITY HETEROGENEITIES OF WATER FROM DEMAND AND SUPPLY ORIENTATIONS IS EVIDENT. THE IMPORTANCE OF DEMAND ORIENTATIONS AND REQUIREMENTS IS PARAMOUNT IN SPECIFYING QUALITY STANDARDS WHICH VARY AMONG USES, SPATIALLY AND TEMPORALLY. SUPPLY QUALITIES MUST BE GEARED TO QUALITIES DEMANDED BY USES. LEAST-COST METHODS ARE NECESSARY IN MEETING DEMAND QUALITIES. IN ASSIGNING BENEFITS AND COSTS TO WATER USES, THE PROBLEMS OF EXTERNALITIES, MEASUREMENT, AND INTERVENTION ARE CRUCIAL. ECONOMICS WITH ITS LEGACY OF METHODS, THEORY, AND ITS CORPS OF RESOURCE ECONOMISTS IS A NECESSARY PART OF THE MULTIDISCIPLINARY APPROACH IN PLANNING AND IN CARRYING OUT RELEVANT RESEARCH NECESSARY FOR EDUCATION, LEGISLATION, AND ADMINISTRATION OF WATER QUALITY MANAGEMENT. (W71-06447)

00497. LIQUID HANDLING OF POULTRY MANURE.

JOHNSON, C.A.
ASAE PAPER NO NA 64-501. TRANSACTIONS OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS, 8, P 124-126, 1965.

THIS ARTICLE DESCRIBES AN INTEGRATED SYSTEM CONCEPT FOR LIQUID MANURE HANDLING OF WASTE PRODUCED BY LAYING HENS IN CONVENTIONAL COMMERCIAL CAGE UNITS. THE BIRD DROPPINGS IN THIS UNIT COLLECT IN 8 INCH DEEP, 44 INCH WIDE TROUGHS FORMED ON ORIGINAL FLOOR WITH 4 INCH THICK CONCRETE BLOCKS. THE LOWER END OF EACH SLOPED TROUGH IS CLOSED WITH A 2 INCH X 6 INCH BOARD. THESE BOARDS ARE REMOVED TO EMPTY THE TROUGHS INTO A 24 INCH BY 24 INCH TRENCH RUNNING ACROSS THE END OF THE BUILDING BELOW FLOOR LEVEL. THIS SLOPING TRENCH EMPTIES INTO A 42 INCH DIAMETER PLASTIC PIPE WHICH CONVEYS THE WASTE TO AN UNDERGROUND SEPTIC TANK. FROM THE THIRD COMPARTMENT OF THIS THREE-COMPARTMENT TANK THE EFFLUENT IS PUMPED BACK INTO THE LAYING HOUSE TO HYDRAULICALLY CLEAN THE TROUGHS BENEATH THE CAGES. THE EFFLUENT BECOMES INCREASINGLY CONCENTRATED. THE EFFLUENT IS PERIODICALLY PUMPEDONTO FOREST LANE AND THE SLUDGE IS 'BATCH' HANDLED. THIS MANURE SYSTEM PROVIDES: (1) EASY MANURE HANDLING, (2) FEW MOVING PARTS, (3) LITTLE AMMONIA ODOR, (4) LOW WATER USAGE, (5) SIMPLE MANURE DISPOSAL, (6) LOS-COST PIT CLEANING. (W71-06450).

00498. AGRICULTURE WASTE RESEARCH NEEDS.

HERR, G.H.
COMPOST SCIENCE, JOURNAL OF WASTE RECYCLING, 11(5), 8-11, 1970.

THE AUTHOR IS RESPONSIBLE FOR DISPOAL OF 17,000 PLUS OR MINUS TONS OF RAW WASTE ANNUALLY FROM A LAYING HEN COMPLEX OF 360,000 HENS. THEIR PROBLEMS INCIDENTAL TO POULTRY 'SHUD' WERE: FIRST - VOLUME ACCUMULATION OF SHUD WITHIN HOUSES, SECOND - COMMUNITY RELATIONS - ODOR PRIMARILY; DANGER OF SOIL AND WATER POLLUTION SECONDARILY. THIRD - ULTIMATE DISPOSAL, AND, FINALLY FOURTH - THE UNKNOWN FACTOR OF THE POSSIBILITY OF, OR THE EFFECT OF, GAS TOXICITY TO THE CHICKENS AND HUMANS. SOME OF THEIR ATTEMPTED AND/OR CONSIDERED METHODS FOR DISPOAL WERE THE USE OF : (1) LAGOONS, (2) IRRIGATION; (3) SEWAGE TREATMENT PLANT, (4) INCINERATION, (5) BURYING, (6) HAULING AND SPREADING, FUTURE CONSIDERATION; (7) SEMIDRYING; (8) POSSIBLE DEHYDRATION - WHICH MIGHT LEAD TO: FERTILIZER PRODUCTS, RE-FEEDING; OR SOME OTHER USES. THEIR CONCLUSION WAS THAT LIQUID HANDLING WOULD NOT BE THE LONG RANGE ANSWER TO THEIR PROBLEMS. THEY CONCLUDED THAT SOME METHOD OF DRY OR SEMI-DRY PROCEDURE MUST DEVELOP AS THEIR SOLUTION AND AS AN INDUSTRY SOLUTION. MR. HERR DESCRIBES THE SYSTEM OF DRYING THE MANURE IN PLACE AND THE COST OF DISPOSAL OF THE SEMI-DRIED (30%) SHUD. (W71-06452).

00499. USE ANIMAL MANURE EFFECTIVELY.

ABBOTT, J.L.
AGRICULTURAL EXPERIMENT STATION AND COOPERATIVE EXTENSION SERVICE BULLETIN A-55, THE UNIVERSITY OF ARIZONA.

THIS PUBLICATION DISCUSSES SOME IMPORTANT CONSIDERATIONS THAT SHOULD BE TAKEN INTO ACCOUNT CONCERNING THE USE OF ANIMAL MANURE AS A FERTILIZER. A POSSIBLE $90-PER-ACRE RETURN FOR A $20-PER-

ACRE INVESTMENT IS BEING OVERLOOKED BY MANY ARIZONA FARMERS. THE COST OF APPLYING MANURE IS ON THE ORDER OF $2 TO $14 PER TON UP TO A 40 MILE HAUL. THE FERTILIZER VALUE OF MANURE IS AT LEAST $2 PER TON FOR AVAILABLE N AND P. THE VALUE OF ORGANIC MATTER MUST ACCOUNT FOR THE BALANCE IN COST. THE GREATEST VALUE OF MANURE MAY RESULT FROM THE INDIRECT EFFECTS OF THE ORGANIC MATTER CONTRIBUTION ON THE PHYSICAL CONDITION OF THE SOIL AND IN MAINTAINING THE AVAILABILITY OF CERTAIN SOIL NUTRIENTS. THE SOLUBLE SALTS IN MANURE COMMONLY RANGE FROM 5 TO 10 PERCENT ON A DRY BASIS. RECOMMENDATIONS FOR MANURE ARE SELDOM MORE THAN 5 TONS PER ACRE ANNUALLY. (W71-06454).

00500. SEPARATE AND COMBINED SEWERS.

WATER WASTES ENG, 5(7), 36, 1968.

REPLIES BY SIX SPOKESMEN FROM VARIOUS REGIONS OF THE UNITED STATES ARE GIVEN IN RELATION TO THE FOLLOWING AREAS OF QUESTIONING: (1) MILE OF SEWERS IN THE AREAS INVESTIGATED; (2) RANGES OF SIZES OF EACH OF THE SEWER TYPES; (3) POPULATION SERVICED BY THE SYSTEM; (4) EFFECT OF COMBINED SEWERS ON TREATMENT PLANT OPERATIONS; (5) SURCHARGING; AND (6)PLANS ON SEWER SEPARATION AND COSTS. (W71-06524).

00501. CHICAGO SEWER DRAIN PROJECT.

ENG NEWS RECORD, 182(10), 41, 1969.

DETAILED STATISTICS ARE GIVEN CONCERNING BIDS FOR A CONTRACT TO CONSTRUCT SEWER DRAINS EXTENDING THE SEWER SYSTEM IN A SECTION OF CHICAGO. CONSOLIDATED CONSTRUCTION CO., INC. WON THIS CONTRACT, AND IT WILL UNDERTAKE THE PROJECT TO PROVIDE FLOOD RELIEF FROM A STORM OF FIVE FREQUENCY OR LESS. INADEQUATE SMALLER SEWERS WILL BE REPLACED, AND A NUMBER OF TRUNK SEWERS AND SIPHONS WILL BE RELIEVED. THE PROJECT WILL BE CONSTRUCTED IN OPEN CUT, AND REINFORCED CONCRETE WILL BE THE PRINCIPAL MATERIAL USED. PRICES FROM THE TWO LOWEST BIDDERS ARE TABULATED FOR EACH OF THE ITEMS TO BE INCLUDED IN THE PROJECT. (W71-06546).

00502. STORM SEWER CHANNEL IN NEBRASKA.

ENG NEWS-RECORD, 181(2), 69, 1968.

BIDS FOR CONSTRUCTING A CHANNEL SECTION OF A STORM SEWER IN OMAHA ARE COMPARED, AND PRICES FOR QUANTITIES OF MATERIALS ARE TABULATED FOR THE TWO LOWEST BIDDERS. A LONG RIPRAPPED, FLAT-BOTTOM DITCH WILL BE FILLED WITH REINFORCED CONCRETE PIPING. THE PROPOSED LENGTH OF THE CHANNEL WAS SHORTENED DUE TO DIFFICULTIES IN OBTAINING EASEMENTS. THE PROJECT WILL IMPROVE ALIGNMENT AND FLOW CAPACITY TO PREVENT PROPERTY DAMAGE BY EROSION. (W71-06548).

00503. SUBURB MEETS URBANIZATION HEAD-ON.

WATER WASTES ENG, 4(11), 47-49, 1967.

THE CITY OF EAST LANSING, MERIDIAN TOWNSHIP BOARD, AND MICHIGAN STATE UNIVERSITY JOINTLY AGREED TO PROVIDE A MUNICIPAL SEWER SYSTEM FOR THE FAST-GROWING COLLEGE AND RECREATIONAL AREA IN INGHAM COUNTY, MICHIGAN. THE ORIGINAL SEPTIC TANKS WERE CONNECTED TO STORM SEWER SYSTEMS WHICH LED TO A NEWLY CONSTRUCTED SEWAGE TREATMENT PLANT. FINANCIAL PROBLEMS AND AN ITEMIZED LIST OF EXPENSES ARE DISCUSSED. (W71-06551).

00504. LEAST COST SAND FILTER DESIGN FOR IRON REMOVAL.

HUANG, J.Y.C.; BAUMANN, E.R.

JOURNAL OF THE SANITARY ENGINEERING DIVISION, ASCE, 97(SA2), 171-190, 1971.

AN EMPIRICAL FILTER PERFORMANCE PREDICTION MODEL WAS USED IN DEVELOPING A COMPUTER PROGRAM FOR PREDICTING SETS OF EQUIVALENT SAND FILTER DESIGNS AND THEIR FIRST AND OPERATING COSTS. IT WAS CONFINED TO A CONSIDERATION OF STUDIES OF THE OPTIMIZATION OF INFLUENT CONTROL, SINGLE-MEDIA SAND FILTERS TO REMOVE IRON FROM SUSPENSION IN WATER. THE EFFECTS ON THE COST OF THE FILTER SYSTEM OF PERTINENT VARIABLES SUCH AS SAND SIZE, SAND DEPTH, TERMINAL HEAD AVAILABLE, FLOW RATE, AND RUN LENGTH WERE EVALUATED. OF THE VARIABLES AFFECTING FILTRATION PERFORMANCE, THE TWO HELD CONSTANT WERE: (1)KIND OF INFLUENT SUSPENDED SOLIDS; AND (2) METHOD OF FILTER OPERATION. THE PERFORMANCE PREDICTION MODEL ASSUMED THAT THE FLOW RATE REMAINED CONSTANT DURING A FILTER RUN. FOR ALL SAND SIZES STUDIED (0.6 MM TO 1.3 MM), THE OPTIMUM DESIGN FILTRATION RATE (4.0 GPM PER SQ. FT. - 5.5 GPM PER SQ. FT.), RUN LENGTH (32 HR. - 42 HR.), AND TERMINAL HEAD LOSS (8 FT. - 11 FT.) ALL CLOSELY APPROXIMATED VALUES USED IN CURRENT PRACTICE. THE OPTIMIZATION TECHNIQUES DEVELOPED TO PREDICT BOTH THE FILTER DESIGNS PROVIDING EQUIVALENT PERFORMANCE AND THEIR COSTS HAVE POTENTIAL APPLICATION IN DESIGN OF NEW FILTRATION PLANTS AND PREDICTION OF OPERATING CONDITIONS, SUCH AS RUN LENGTH AND EFFLUENT QUALITY, OF EXISTING SAND FILTRATION PLANTS. (W71-06585).

00505. ENVIRONMENTAL QUESTIONS THAT NOBODY LIKES TO HEAR.

AM CITY, 85(3), 8, 1970.

THIS SHORT REVIEW SUMMARIZES ENVIRONMENTAL PROBLEMS IN THE UNITED STATES SUCH AS WATER POLLUTION, REFUSE COLLECTION AND DISPOSAL, MINERAL DEPLETION, AND AIR POLLUTION. UNDER WATER POLLUTION, IT IS NOTED THAT $48 BILLION IS REQUIRED TO SEPARATE SEWERS IN THE U. S. IN ORDER TO CORRECT EFFECTS OF STORMWATER OVERFLOW. GRIM PREDICTIONS CONCERNING THE ENVIRONMENT ARE MADE, AND IMMEDIATE ACTION TO IMPROVE CONDITIONS IS ADVOCATED. (W71-06627).

00506. URBAN RUNOFF ADDS TO WATER POLLUTION.

ENVIRON SCI TECHNOL, VOL 3, NO 6, P 527, JUN 1969.

AN APWA SURVEY INDICATED THAT : (1) URBAN RUNOFF CONSTITUTES APPROXIMATELY 1% OF THE RAW SEWAGE LOAD WHICH AMOUNTS TO 5% OF THE BOD DISCHARGED FROM THE AREA'S SECONDARY WASTE TREATMENT FACILITIES; (2) WATER POLLUTION FROM THIS URBAN SOURCE OCCURS CREATING A SHOCK POLLUTION LOAD ON RECEIVING WATERS, (3) THE MOST DETERMINABLE MEASURE OF POLLUTION POTENTIAL OF STREET LITTER IS THE BOD LOAD OF THE SOLUBLE DUST AND DIRT FRACTION; (4) AN ESTIMATED EXPENDITURE OF $48 BILLION WOULD BE NEEDED TO SEPARATE SANITARY AND STORM WATERS; AND, (5) $15 BILLION WOULD BE NEEDED FOR ALTERNATE CONTROL METHODS FOR ABATEMENT OF COMBINED SEWER OVERFLOWS. (W71-06634).

REFERENCE LIST

00507. ON THE CONCEPT OF MUNICIPAL SEWERAGE SYSTEMS.

FATHMANN, H.
IWL FORUM 66/1, P 1-23, 1966.

THE AUTHOR DEALS WITH VARIOUS PROBLEMS WHICH ARE ENCOUNTERED IN THE DESIGN AND OPERATION OF SEWAGE WORKS FOR LOCAL COMMUNITIES. PARTICULAR REFERENCE IS GIVEN TO THE COST OF DRAINAGE SYSTEMS AND MECHANICAL TREATMENT PLANTS, THE CONTROL OF STORM SEWAGE OVERFLOWS, THE OPERATION OF SCREENS, DETRITUS, SEDIMENTATION AND HUMUS TANKS, AND THE ADVANTAGES OF PERCOLATING FILTERS AND ACTIVATED-SLUDGE PLANTS. (W71-06654).

00508. ELECTRODIALYSIS WATER TREATMENT.

RUEBSAMEN, W.B.
THE MILITARY ENGINEER, 63(411), 34-36, 1971.

TWO METHODS OF TREATMENT OF GROUNDWATER SUPPLY AT GRAND FORKS AIR FORCE BASE, N. D. ARE DESCRIBED AND EVALUATED. ELECTRODIALYSIS IS A PROCESS USING ELECTRODES AND SEMIPERMEABLE MEMBRANES THAT PERMIT THE PASSAGE OF EITHER CATIONS OR ANIONS. REVERSE OSMOSIS IS A PROCESS USING HIGH PRESSURE AND A SEMIPERMEABLE MEMBRANE. THE DECISION OF WHICH UNIT TO USE WAS BASED ON ITS PRODUCTION PERFORMANCE. THE TEST AND FAILURE DATA SHOW THE ELECTRODIALYSIS UNIT TO BE SUPERIOR IN PERFORMANCE AND RELIABILITY. THROUGH USE OF THE ELECTRODIALYSIS WATER TREATMENT SYSTEM, THE MONEY SAVED FROM THE MAINTENANCE OF THE OLD DISTILLATION PROCESS HAS PAID FOR THE PURCHASE, INSTALLATION, AND OPERATIONAL COST. IT IS HIGHLY RELIABLE, AIDS IN EXTENDING THE LIFE OF OTHER WATER-USING EQUIPMENT, AND IS EASY TO OPERATE AND MAINTAIN. (W71-06660).

00509. UNDERFLOW SEWERS FOR CHICAGO.

PIKARSKY, M; KEIFER, C.J.
CIVIL ENG, 67(5), 62-65, 1967.

CHICAGO IS PLANNING AN UNDERFLOW SEWER SYSTEM CONSISTING OF A LARGE TUNNEL UNDER RIVERS AND CANALS INTO WHICH ALL COMBINED SEWERS WILL DISCHARGE. THIS SYSTEM, COSTING $400 MILLION DOLLARS, WILL ELIMINATE THE NEED FOR A $4 BILLION DOLLAR CONVENTIONAL SEPARATE SEWER BECAUSE SPILLAGES FROM COMBINED SEWERS WILL BE DIRECTED TO THE UNDERGROUND TUNNEL RATHER THAN POLLUTING SURFACE STREAMS. THE PERFORMANCE OF THE LAWRENCE AVE. UNDERFLOW SEWERS WAS ANALYZED THROUGH A COMPUTER SIMULATION OF THE SYSTEM. UNTREATED OVERFLOW INTO LOCAL STREAMS WAS REDUCED FROM 3%/YEAR OF THE SEWAGE FROM COMBINED SEWERS TO .8% FROM LAWRENCE AVE. 'S UNDERFLOW SEWERS. (W71-06752).

00510. BRITAIN AND THE AMERICAN WATER QUALITY CRISIS.

WOOD, R.
EFFLUENT WATER TREAT J, 10(6), 316-317, 319-321, 1970.

BRITAIN'S SHORTCOMINGS WITH REGARD TO WATER POLLUTION CONTROL STEM FROM A FAILURE OF FINANCIAL INVESTMENTS IN CONTROL PLANTS TO KEEP PACE WITH THE CHANGING TECHNOLOGY OF INDUSTRIAL PROCESSES AND THEIR EFFECTS ON BOTH DOMESTIC AND MIXED-MUNICIPAL SEWAGE. A COMPARATIVE COST ANALYSIS BETWEEN BRITAIN AND THE UNITED STATES CONCERNING WATER POLLUTION CONTROL IS DISCUSSED INCLUDING: COST PERCENTS APPRORIATED FOR EQUIPMENT, INDUSTRIAL WASTE TREATMENT, MUNICIPAL SEWAGE TREATMENT, AND RIVER POLLUTION ABATEMENT. BASIC PURIFICATION STANDARDS ARE INCLUDED AS WELL AS EFFLUENT STANDARDS. THE AUTHOR EXPANDS ON THE IDEA THAT THE EXPORTATION OF POLLUTION CONTROL EQUIPMENT SUCH AS INSTRUMENTATION AND CONTROL SYSTEMS TO THE UNITED STATES IS ONE AREA IN WHICH THE BRITISH MAY CONTRIBUTE THEIR TECHNOLOGICAL ADVANCES IN AIDING BOTH THE UNITED STATES AND BRITAIN. (W71-06757).

00511. COST-SHARING UNDER THE AGRICULTURAL CONSERVATION PROGRAM.

HOOVER, K.H.
PROCEEDINGS OF FARM ANIMAL WASTE AND BYPRODUCT MANAGEMENT CONFERENCE, UNIVERSITY EXTENSION, UNIVERSITY OF WISCONSIN, P 98-100, NOVEMBER 6-7, 1969.

PRACTICES AND OBJECTIVES OF THE AGRICULTURAL CONSERVATION PROGRAM (ACP) HAVE BEEN BROADENED TO INCLUDE POLLUTION ABATEMENT, PROVIDED SUCH PRACTICES ALSO RESULT IN SOIL AND/OR WATER CONSERVATION. THE AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE (ASCS) MANAGES PROGRAM FUNDS OF THE ACP. A LIST OF COMPONENTS THAT OUGHT TO BE INCLUDED IN POLLUTION ABATEMENT COST-SHARING PRACTICES IS GIVEN. MOST PRACTICES RECEIVE COST-SHARING AT 80% OF COST. FARMER ACCEPTANCE AND FINANCIAL CONTRIBUTION ARE NEEDED TO ACCOMPLISH THE STATED OBJECTIVES. (W71-06827).

00512. RE-USING STORM RUN-OFF.

ENVIRON SCI TECHNOL, VOL 2, P 1001-1005, 1968.

A DESIGN AND COST STUDY OF THE 1100-ACRE WILDE LAKE WATERSHED IN COLUMBIA, MD., WHICH CONSIDERS THE TREATMENT OF RUNOFF AND ITS USE AS POTABLE WATER, IS DESCRIBED. THE SCHEME INCLUDES THE COLLECTION AND STORAGE OF RUNOFF IN 10 SMALL LAKES AND PRELIMINARY TREATMENT THERE BY SEDIMENTATION, CHEMICAL COAGULATION, AND CHLORINATION. (W71-06849).

00513. LOWESTOFT CHOOSES TUNNEL FOR SEWAGE OUTFALL.

SURVEYOR, 84(4030), 18, 1969.

THE SEWAGE OUTFALL PROJECT AT LOWESTOFT IS CONTROVERSIAL IN CONCEPT AS WELL AS IN MODE OF CONSTRUCTION. PROBLEMS OF SUCH OUTFALLS INCLUDE THEIR FREQUENT DAMAGE BY HEAVY SEAS AND THEIR QUESTIONABLE ABILITY TO ADEQUATELY DISPERSE EFFLUENTS. SEA CURRENTS AT DISCHARGE POINTS WERE INVESTIGATED AND FOUND TO BE CONDUCIVE TO PROPERLY CARRYING EFFLUENT OUT TO SEA. THE SLIGHTEST BEACH POLLUTION, HOWEVER, WILL PROMOTE INTENSE PUBLIC DISTRUST OF THE PLAN. DISCHARGE SHAFTS OF THE TUNNEL BENEATH THE SEA-BED WILL BE RAISED THROUGH THE USE OF MASSIVE HYDRAULIC JACKS, AND UNUSUAL TECHNIQUE. BOTH THE TUNNEL WORK AND THE SHAFT RAISING WILL BE DONE EMPLOYING COMPRESSED AIR. DIMENSIONS OF THE TUNNEL AND OTHER CONSTRUCTION TECHNIQUES AND PROBLEMS ARE RELATED. THE SCHEME ADOPTED IS INEXPENSIVE WITH REGARD TO CAPITAL AND SERVICE COSTS. A COMPLETE SEWAGE TREATMENT WORKS FOR THE TOWN WOULD COST AT LEAST TWICE AS MUCH. (W71-06854).

00514. LAUNCHING A TWO MILE SEWAGE OUTFALL.

SURVEYOR, 82(3978), 16-17, 1968.

THE HASTINGS WESTERN AREA MAIN DRAINAGE SCHEME INCLUDES A SEWERAGE OUTFALL, TWO NEW PUMPING STATIONS, A PARTIAL TREATMENT WORKS, AND A PUMPING MAIN. THE SCHEME WAS DESIGNED TO REPLACE TWO CONVENTIONAL OUTFALLS WHICH CAUSED POLLUTION OF THE FORESHORE AND SHALLOW WATER BECAUSE OF INSUFFICIENT LENGTH. THE NEW OUTFALL WAS BUILT UP INTO SEVEN STRINGS IN A SPECIAL ASSEMBLY AREA, AND THESE SECTIONS WERE JOINED SUCCESSIVELY BEFORE THE ENTIRE PIPE WAS LAUNCHED INTO ITS FINAL POSITION ON THE SEA BED. FURTHER CONSTRUCTION PROCEDURES ARE EXPLAINED ALONG WITH THE MEANS USED TO DETERMINE THE PROPER LENGTH OF THE OUTFALL. THE NEW PUMPING STATION PUMPS SEA SEWAGE FLOWS UP TO 6 D. W. F., AND A DISCHARGE TO A STORMWATER SUMP. THE SUMP CONNECTS TO THE FORESHORE BY A CULVERT AND FOR SEA LEVELS BELOW MID-TIDE, STORMWATER DISCHARGES TO SEA BY GRAVITY. AT TIMES WHEN THE CULVERT IS TIDE-LOCKED, A STORMWATER PUMP OPERATES. COSTS, DIMENSIONS, AND OTHER DETAILS OF THE ENTIRE SCHEME ARE INCLUDED IN THE ARTICLE. (W71-06859).

00515. THE UNABATED GROWTH OF WATER POLLUTION ABATEMENT ACTIVITIES.

MONTGOMERY, A.H. JR.

CONSULTING ENGR, 33(5), 114-117, 1969.

WATER POLLUTION ABATEMENT ACTIVITIES WERE GIVEN AUTHORITY AND DIRECTION BY THE FEDERAL WATER QUALITY ACT OF 1965. AN ESTIMATED COST OF $48 BILLION IS NECESSARY FOR THE SEPARATION OF COMBINED SANITARY AND STORM SEWERS. THE TRADITIONAL PRIMARY-SECONDARY TREATMENT PLANTS' OBJECTIVES AND ACHIEVEMENTS USUALLY HAVE BEEN NOT TO RESTORE BUT TO SLOW DOWN OR PREVENT FURTHER DEGRADATION. LACK OF KNOWLEDGE OF THE EXTENT AND MEANS OF TREATING POLLUTION SOURCES SUCH AS PESTICIDES, ACID, EROSION, FERTILIZERS, AND MINE DRAINAGE, IS A FACTOR IN DELAYING THE ABATEMENT PROGRAM. A LIST OF CONSULTING ENGINEERING FIRMS, WHICH HAVE BEEN AWARDED RESEARCH AND DEVELOPMENT GRANTS AND CONTRACTS FOR ADVANCED WASTE WATER TREATMENT TECHNIQUES, IS GIVEN. THE TREND IN THE REUSE RATHER THAN DISCHARGE OF WASTE WATER IS WELL UNDER WAY, AND THE MOST WIDESPREAD REUSE TODAY IS THAT OF SECONDARY TREATMENT EFFLUENT AS A WATER SOURCE FOR INDUSTRY AND AGRICULTURE. A NEED FOR PROFESSIONAL WATER POLLUTION CONTROL IS EMPHASIZED. (W71-06889).

00516. DETROIT'S METROPOLITAN WATER POLLUTION CONTROL PROGRAM - IN ACTION.

REMUS, G.J.

THE ENGINEER AND THE CITY, P 91-96, 1969.

THE ADOPTION OF METROPOLITAN PROGRAMS FOR WATER SUPPLY, POLLUTION CONTROL, AND SEWAGE TREATMENT IN THE DETROIT AREA RECEIVED ITS IMPETUS IN 1959. A BRIEF REVIEW OF THE GROWING ACCEPTANCE OF THE PROGRAMS IS GIVEN. THE SEWAGE SYSTEM FOR DETROIT OPERATES ON A COMBINED STORMWATER-SANITARY SEWAGE BASIS WITH THE USE OF REMOTE CONTROLS, AUTOMATIC ALARMS, AND COMPUTER RECORDINGS (INCLUDING RECORDS ON HOW A STORM CROSSES A METROPOLITAN AREA). THE STORMFLOW DIRT DEPOSIT TO THE DETROIT RIVER HAS BEEN REDUCED BY AT LEAST 15%. APPROXIMATELY $371 MILLION WILL BE SPENT FROM 1966 TO 1975 ON THIS WATER POLLUTION CONTROL PROGRAM. RECOMMENDATIONS FOR FURTHER STUDIES AND PROGRAMS ARE MADE BY THE AUTHOR, AND AN ESTIMATED COST LIST ON THE SEWAGE DISPOSAL CONSTRUCTION IS GIVEN. (W71-06892).

00517. THE REUSE OF TREATED MUNICIPAL WASTE BY THE MIDLAND DIVISION, THE DOW CHEMICAL COMPANY.

SHANNON, E.S.; MAASS, A.

PAPER PRESENTED AT THE AM WATER WORKS ASSOC, ANNUAL CONFERENCE, WASHINGTON, D.C. JUN 21-26, 1970.

IN JUNE 1969, THE DOW CHEMICAL COMPANY STARTED TO TAKE INTO ITS COOLING WATER AND FIRE PROTECTION SYSTEM THE TREATED SEWAGE FROM THE CITY OF MIDLAND, MICHIGAN. THE SUPPLEMENTAL WATER SUPPLY WILL PROVIDE UP TO SEVEN MILLION GALLONS PER DAY OF RELATIVELY HIGH QUALITY WATER AND THE RESERVOIR WILL PROVIDE A THREE MILLION GALLON FIRE WATER SUPPLY. THE MIDLAND WASTE WATER TREATMENT SYSTEM CONSISTS OF PRIMARY, AND TWO STAGE TRICKLING FILTER SECONDARY TREATMENT, FOLLOWED BY CHLORINATION. THERE IS ALSO A THREE MILLION GALLON RESERVOIR, TWO SIX THOUSAND GALLON PER MINUTE PUMPS, AND ASSOCIATED CONTROLS AND PIPING. THE TOTAL COST OF THE PROJECT IS ESTIMATED AT $500,000. (W71-06895).

00518. DEEP TUNNEL STORAGE MAY SOLVE CITY STORM WATER PROBLEM.

ENVIRON SCIE TECHNOL, 3(3), 209-211, 1969.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO (MSD) HAS A PLAN DEVISED FOR THE CONTROL OF POLLUTION FROM STORM AND COMBINED SEWER WATER RUNOFF-- THE CHICAGOLAND DEEP TUNNEL PROJECT. THIS PLAN WOULD: CAPTURE FLOW FROM A 300 SQUARE-MILE SECTION; COST APPROXIMATELY $1.02 BILLION ($. 02 BILLION MORE THAN THE PRESENT SEWAGE TREATMENT FACILITIES' COST); AND, ALMOST COMPLETELY REMOVE BOD FROM THE STORMWATER RUNOFF AT 1/4 THE COST OF AVAILABLE ALTERNATIVES. THE HARZA ENGINEERING CO. AND BAUER ENGINEERING INC. ARE THE TWO CONSULTING FIRMS WORKING ON THE PROJECT WHICH MAY DEVELOP INTO A $2.2 BILLION WATER QUALITY PROGRAM. COMMENTS BY VINTON BACON, GENERAL MANAGER OF THE SANITARY DISTRICT, ARE MADE ON THE URGENCY OF THE PROJECT, THE NECESSARY REASONS FOR THE PROJECT, AND THE BENEFITS FROM THE PROJECT. A COST LIST IS GIVEN AS WELL AS A SHORT DESCRIPTION OF THE TUNNEL SYSTEM LAYOUT. (W71-06981).

00519. SECOND INTERNATIONAL SYMPOSIUM FOR WASTE TREATMENT LAGOONS.

SPONSORED BY MISSOURI BASIN ENGINEERING HEALTH COUNCIL, AND FEDERAL WATER QUALITY ADMINISTRATION. 1970, KANSAS CITY, MISSOURI. 404 P.

LAGOONS - AEROBIC, ANAEROBIC, FACULTATIVE, AND AERATED - ARE DISCUSSED BOTH AS TO THEIR PAST HISTORY AND ALSO TO THEIR FUTURE APPLICATIONS. LAGOONING HAS BEEN APPLIED TO NEARLY ALL TYPES OF WASTES BOTH DOMESTIC AND INDUSTRIAL WITH SUCCESS. THE MAIN REASONS FOR THIS UNIVERSAL APPLICATION ARE: (1) LOW INITIAL COST AS LONG AS LAND VALUES ARE REASONABLE; (2) MINIMUM MAINTENANCE EXPENSES; AND (3) LONG SYSTEM WORKING LIFE. THE BASIC DESIGN CONSIDERATIONS FOR THE CONSTRUCTION

OF LAGOONS ARE: (1) AREAL BOD LOADING; (2) TEMPERATURE; (3) NATURE OF ORGANICS PRESENT; (4) CLIMATIC CONDITIONS BOTH AS TO TEMPERATURE AND RAINFALL; AND (5) CONDITION OF THE SOIL UPON WHICH THE LAGOONS ARE TO BE BUILT. PAPERS PRESENTED AT THE SYMPOSIUM COVER THE FULL RANGE OF OPINIONS, FROM BOTH PROPONENTS AND OPPONENTS. DESIGN CRITERIA ARE PRESENTED FOR NEARLY EVERY TYPE OF SYSTEM CONFIGURATION IMAGINABLE. THE UNDERLYING THEME, HOWEVER, HAS BEEN ONE OF RECOGNITION OF THE NEED FOR MORE DETAILED AND COMPLETE EXPERIMENTS AND INVESTIGATION TO MORE FULLY DEFINED LAGOON PERFORMANCE AND OPERATION. (W71-07079).

00520. THE ROLE OF PONDS IN WASTE WATER TREATMENT.

ALLUM, M.O.; CARL, C.E.

2ND INTERNATIONAL SYMPOSIUM FOR WASTE TREATMENT LAGOONS, JUNE 23-25, 1970, KANSAS CITY, MISSOURI, P 7-10.

MAN-MADE PONDS DESIGNED FOR WASTE TREATMENT HAVE A WIDE VARIETY OF APPLICATIONS TO A WIDE RANGE OF WASTES. SOUTH DAKOTA HAS STATE REGULATIONS GOVERNING THE LOADING ON SUCH PONDS, BUT LITTLE OTHER CARE OR MAINTENANCE IS REQURIED AT THESE INSTALLATIONS. POND SIZES RANGE FROM ABOUT .08 ACRES TO 284 ACRES, AND PROVIDE EFFICIENT TREATMENT FOR COMMUNITIES WHETHER THEY ARE OVERNIGHT CAMP GROUNDS, OR CITIES OF 10 TO 15,000 POPULATION. PONDS HAVE ALSO BEEN USED FOR MANY INDUSTRIAL WASTE PROBLEMS. SLAUGHTER HOUSE WASTES, FOOD PROCESSING WASTES, SUGAR BEET PROCESSING WASTES, PHENOLS, AND MANY OTHER DIFFERENT INDUSTRIAL DISCHARGES HAVE BEEN SUCCESSFULLY TREATED IN PONDS. PERIODIC INSPECTION AND REPAIR OF THE DIKES IS VIRTUALLY THE ONLY REQUIRED MAINTENANCE. THE COST OF PONDS IS ALMOST TOTALLY DEPENDENT UPON LAND COSTS, AND IS THEREFORE PARTICULARLY SUITED TO SOUTH DAKOTA'S COMPARATIVELY INEXPENSIVE LAND SITUATION. THE ONLY SERIOUS DRAWBACK OF PONDS IS THEIR SPRING ODOR PROBLEMS. THESE PROBLEMS ALSO OCCUR DURING OVERLOADING, EVEN THOUGH OVERALL TREATMENT MAY STILL BE QUITE GOOD. (W71-07081).

00521. A COMPARISON OF AN EFFICIENT LAGOON SYSTEM WITH OTHER MEANS OF SEWAGE DISPOSAL IN SMALL TOWNS.

SCHURR, K.

2ND INTERNATIONAL SYMPOSIUM FOR WASTE TREATMENT LAGOONS, JUNE 23-25, 1970, KANSAS CITY, MISSOURI, P 95-100.

AN OXIDATION LAGOON AND A CONVENTIONAL PRIMARY-SECONDARY SEWAGE TREATMENT FACILITY WERE COMPARED WITH RESPECT TO PH, TURBIDITY, NITRATES, PHOSPHATES, NITRITES, CHLORIDE, CONDUCTIVITY, AND COLIFORM BACTERIA, BY COMPARING THE FINAL TANK OF THE LAGOON SYSTEM TO THE RECEIVING STREAM OF THE CONVENTIONAL SYSTEM. THE OXIDATION LAGOON WAS FOUND TO PROVIDE A SIGNIFICANTLY HIGHER DEGREE OF WASTE TREATMENT AT A LOWER COST. THE RESULTS OF THE LAGOON VERSUS CONVENTIONAL TREATMENT COMPARISON INDICATE THAT LAGOONS MAY BE OF SIGNIFICANT VALUE IN SMALLER TOWNS AND CITIES WHERE ECONOMY IS ESSENTIAL. IN MOST OF THE SMALLER TOWNS, LAND VALUES ARE WITHIN THE RANGE OF PRICE WHERE ECONOMICAL LAGOONS MAY BE BUILT. OTHER ATTRACTIVE FEATURES OF LAGOONS ARE THEIR LOW MAINTENANCE COSTS, AND LESSER LABOR REQUIREMENTS. MORE WORK IS NECESSARY TO IMPROVE THE EFFICIENCY OF LAGOONS, BUT THEY ARE ALREADY A PROMISING ALTERNATIVE TO AREAS WHICH NEED TREATMENT FACILITIES BUT CANNOT AFFORD CONVENTIONAL PLANTS. (W71-07091).

00522. AERATED LAGOONS FOR POTATO PROCESSING WASTES.

DOSTAL, K.A.

2ND INTERNATIONAL SYMPOSIUM FOR WASTE TREATMENT LAGOONS, JUNE 23-25, 1970, KANSAS CITY, MISSOURI, P 243-249.

PILOT-SCALE PLANTS WERE OPERATED FOR TWO NINE MONTH PROCESSING SEASONS ON POTATO WASTES. 4200 GALLONS OF FRESH WATER WERE USED TO PROCESS EACH TON OF POTATO WASTES, PRODUCING 90 LBS OF BOD, 210 LBS OF COD, 110 LBS OF SUSPENDED SOLIDS, 6 LBS OF TOTAL PHOSPHATES AS P, AND 3.5 LBS OF TOTAL NITROGEN AS N ON THE NINE MONTH AVERAGE. SCHEMATIC DIAGRAMS OF THE PILOT PLANTS WERE CONSTRUCTED AND ARE PRESENTED. FROM THE PRECEEDING STUDIES, THE FOLLOWING CONCLUSIONS WERE OBTAINED: (1) EITHER AN AEROBIC LAGOON OR AN ANAEROBIC-AEROBIC LAGOON SERIES IN CONJUNCTION WITH PRIMARY SEDIMENTATION CAN ACHIEVE AS HIGH AS 90% BOD RECUCTION, (2) BOTH SYSTEMS ARE ECONOMICALLY FEASIBLE, THE CHOICE DEPENDENT UPON LOCAL CONDITIONS, (3) CONSTANTS DERIVED FROM THIS STUDY WERE USED TO FORMULATE MODELS TO ADEQUATELY DESCRIBE BOD REDUCTION ACROSS THE PONDS, (4) CHEMICAL ADDITIONS WERE NOT REQUIRED FOR EITHER PH CONTROL OR INORGANIC NUTRIENT ADJUSTMENT; AND (5) SOME METHOD OF SUSPENDED SOLIDS REMOVAL WILL USUALLY BE REQUIRED. SEVERAL FULL SCALE INSTALLATIONS HAVE RECENTLY BEEN PLACED IN SERVICE, BUT DATA IS NOT YET AVAILABLE. (W71-07107).

00523. A COMPARATIVE STUDY OF AERATED LAGOON TREATMENT OF MUNICIPAL WASTE WATERS.

BURNS, G.E.; GIRLING, R.M.; PICK, A.R.; VAN ES, D.W.

2ND INTERNATIONAL SYMPOSIUM FOR WASTE TREATMENT LAGOONS, JUNE 23-25, 1970, KANSAS CITY, MISSOURI, P 258-276.

THREE PILOT SCALE AERATED LAGOONS WERE CONSTRUCTED AT WINNIPEG, CANADA, TO TEST THE EFFECT OF THE CANADIAN PRAIRIE CLIMATIC CONDITIONS ON LAGOON OPERATION. THE PILOT CELLS WERE OF THE ANAEROBIC-AEROBIC TYPE. EACH LAGOON WAS EQUIPPED WITH A DIFFERENT TYPE OF AERATION SYSTEM, DIFFUSED AIR, SURFACE AERATORS, OR A COMBINATION OF BOTH. TESTS WERE CONDUCTED OVER A 20 MONTH PERIOD ON AN INFLUENT AVERAGING 175 MG/L BOD AND 188 MG/L OF SUSPENDED SOLIDS. FROM THE RESULTS OF THIS INVESTIGATION, IT WAS CONCLUDED THAT AERATED LAGOONS CAN SATISFACTORILY PROVIDE SECONDARY TREATMENT UNDER PRAIRIE CLIMATIC CONDITIONS. BOD REMOVAL EFFICIENCY AND DISSOLVED OXYGEN CONCENTRATION BOTH UNDERGO A SEASONAL SUMMER DECLINE DUE TO THE BUILD-UP OF SLUDGE DURING THE SUMMER MONTHS. THE PREVAILING CONSIDERATION FOR ECONOMIC FEASIBILITY OF AN AERATED LAGOON SYSTEM IS THE EXTENT AND COST IMPLICATIONS OF SLUDGE REMOVAL AND DISPOSAL FACILITIES. ALSO THE USE OF SURFACE AERATORS WAS DEMONSTRATED TO BE IMPRACTICAL IN AREAS WHICH SUSTAIN LARGE AMOUNTS OF ICE COVER. RESEARCH IS CONTINUING ON THE ECONOMIC FACTORS INVOLVED IN SLUDGE REMOVAL AND DISPOSAL. (W71-07109).

00524. OPERATIONAL EXPERIENCES WITH SEWAGE LAGOONS.

WILLIAMS, C.H.
2ND INTERNATIONAL SYMPOSIUM FOR WASTE TREATMENT LAGOONS, JUNE 23-25, 1970, KANSAS CITY, MISSOURI, P 32' 332.

THE FIRST SLUDGE LAGOONS WERE INSTALLED IN DALLAS, IN 1940, AND WERE USED FROM THEN UNTIL THE PRESENT TIME. IN 1960, IT BECAME EVIDENT THAT THEY WERE SERIOUSLY OVERLOADED. THE PROBLEM THEN BECAME ONE OF WHAT TO REPLACE THEM WITH. AFTER MUCH STUDY, A SYSTEM OF LAGOONS WAS CONSTRUCTED FOR USE AS TERTIARY DIGESTERS AT AN INITIAL COST OF $251,000. OPERATING COSTS INVOLVE 100 MAN HOURS/YEAR AND $1200 FOR ELECTRICITY PER YEAR. IN COMPARISON, DRYING AND/OR INCINERATION OF THE SLUDGE REQUIRED AN INITIAL COST OF $20,000,000, AND $1,000,000/YEAR OPERATING COSTS. AFTER 7 YEARS, 1/3 OF THE CAPACITY OF THE LAGOONS HAS BEEN USED UP AND NOW CONTRIBUTES ONLY STORAGE FOR THE REFRACTORY MATERIALS. A LONG RANGE PLAN INCLUDES CONSTRUCTION OF ADDITIONAL MULTI-CELL SERIES LAGOONS WHICH ARE FURTHER REMOVED FROM POPULATED AREAS. ODOR CONTROL AT THE PRESENT INSTALLATION HAS BEEN IMPERATIVE SINCE THE PLANT IS COMPLETELY SURROUNDED BY THE CITY OF DALLAS. A BETTER UNDERSTANDING OF SEEDING OF FEED, MIXING REQUIREMENTS, SCUM AND ODOR CONTROL, LINING OF UNITS, AND THE SUPERIORITY OF ANAEROBIC DIGESTION FOR THIS SITUATION HAS BEEN ATTAINED FROM EXPERIENCE WITH THE PRESENT PLANT. THIS KNOWLEDGE WILL BE APPLIED TO FUTURE PLANTS IN THEIR DESIGN AND HOPEFULLY THESE PLANTS WILL BE MUCH IMPROVED. (W71-07117).

00525. CHALLENGE FOR WASTE WATER LAGOONS.

MIDDLETOWN, F.M.; BUNCH, R.L.
2ND INTERNATIONAL SYMPOSIUM FOR WASTE TREATMENT LAGOONS, JUNE 23-25, 1970, KANSAS CITY, MISSOURI, P 364-366.

INCREASING USE OF WATER HAS NECESSITATED GREATER AND GREATER USAGE OF RECONDITIONED WASTE WATER AS DRINKING WATER. WITH THIS GREATER USAGE HAS COME INCREASINGLY STRICTER LAWS REGARDING THE QUALITY OF THE EFFLUENT WHICH A TREATMENT FACILITY IS PERMITTED TO DISCHARGE TO A RECEIVING WATER. THEREFORE TREATMENT METHODS MUST BECOME MORE SOPHISTICATED AS TIME GOES ON IN ORDER THAT EFFLUENTS NOT ONLY PRESERVE THE QUALITY OF A RECEIVING STREAM, BUT MUST HELP TO RESTORE IT. IN LIGHT OF THESE FACTS LAGOON PERFORMANCE MUST BE EVALUATED WITH RESPECT TO FUTURE CONDITIONS. LAGOONS HAVE SEVERAL DRAW BACKS FROM A WATER POLLUTION STANDPOINT. THESE ARE: (1) ALTHOUGH COLIFORMS MAY BE REDUCED AS MUCH AS 98% IN A LAGOON, THE WATER QUALITY STANDARDS FOR NUMBER OF ORGANISMS PER MILLILITER MAY STILL BE VIOLATED; (2) IF ALGAE IS ALLOWED TO PASS TO THE RECEIVING STREAM, IT MAY BECOME AS MUCH OF A POLLUTIONAL FACTOR AS THE RAW WASTE SINCE IT CONTAINS THE SAME AMOUNT OF ORGANIC MATTER; (3) LAGOON EFFLUENT IS HIGH IN SUSPENDED SOLIDS WHICH ARE BOTH AESTHETICALLY UNPLEASING AND OXYGEN DEMANDING; (4) LAGOONS ARE A THREAT TO GROUNDWATER QUALITY BECAUSE OF THE DIFFICULTY IN SEALING THEM. UNTIL NOW, THE MOST ATTRACTIVE FEATURE OF LAGOONS HAS BEEN THIR LOW COST. AS TREATMENT MUST BECOME MORE SOPHISTICATED, LAGOONS AS PRESENTLY CONSTRUCTED WILL NEED ADDITIONAL TREATMENT WHICH WILL MORE THAN OFFSET THEIR COST ADVANTAGE. THEREFORE, UNLESS SIGNIFICANT ADVANCES ARE MADE IN LAGOON TECHNOLOGY, IT IS DOUBTFUL IF LAGOONS WILL HAVE A PLACE IN THE FUTURE. (W71-07123)

00526. WATER SEWER AND DRAINAGE PLAN FOR FORT SMITH URBANIZING AREA, PHASE II.

ARKHOMA REGIONAL PLANNING COMMISSION, FORT SMITH, ARKANSAS, JUNE 1970. VOLUME II, 232 P.

A UNIFIED SANITARY SEWER SYSTEM IS RECOMMENDED TO SERVE THE URBANIZING AREA OF FORT SMITH WHICH INCLUDES COMMUNITIES IN BOTH ARKANSAS AND OKLAHOMA. OF THE TEN COMMUNITIES IN THIS AREA, ONLY FORT SMITH, VAN BUREN AND ALMA HAVE PUBLIC SEWER SYSTEMS AND PUBLIC SEWAGE TREATMENT FACILITIES. THE OTHERS WHICH RANGE IN POPULATION FROM 200 TO 2,000 PERSONS ARE SERVED THROUGH INDIVIDUAL SEPTIC TANKS. IT IS ESTIMATED THAT THE POPULATION WILL INCREASE FROM THE PRESENT 97,150 TO 198,000 BY 1990. LARGE DISTANCES BETWEEN GROWTH CENTERS AND A DIVERSITY OF DRAINAGE AREAS IMPEDE THE DEVELOPMENT OF A UNIFIED AREAWIDE SEWERAGE SYSTEM AND CENTRAL DISPOSAL FACILITIES. SEWAGE LIFT STATIONS WILL BE REQUIRED TO CONDUCT FLOWS TO THE ARKANSAS RIVER TO AVOID CONSTRUCTING LENGTHY SEWER LINES. THE RIVER SEPARATES THE URBANIZING AREA INTO TWO PARTS. THIS DICTATES THAT TWO SYSTEMS OF INTERCEPTOR SEWERS SHOULD BE BUILT PARALLELING THE STREAM. IT IS RECOMMENDED THAT TWO ACTIVATED SLUDGE SEWAGE TREATMENT PLANTS BE BUILT DOWNSTREAM FROM THE URBANIZING AREA, ONE ON EACH SIDE OF THE RIVER. AREAWIDE REQUIREMENTS TO FACILITATE CONNECTING EVEN THE SMALLEST RESIDENTIAL DEVELOPMENTS TO INTERCEPTOR SEWERS WHEN FEASIBLE ARE RECOMMENDED. INTERIM SEWAGE TREATMENT FACILITIES INVOLVING STABILIZATION PONDS OR PACKAGE PLANTS ARE SUGGESTED UNTIL CONNECTIONS CAN BE MADE TO FUTURE INTERCEPTOR SEWERS. DESIGN CRITERIA, CAPACITY REQUIREMENTS, CONSTRUCTION AND OPERATING COSTS, USER CHARGES, LEGISLATIVE NEEDS, FINANCING, COST SHARING, EXISTING SYSTEM DEFICIENCIES, RECOMMENDED IMPROVEMENTS, AND STORM DRAINAGE NEEDS ARE DISCUSSED (PB-195 690) (W71-07191).

00527. A STUDY OF LOCAL NEEDS FOR WATER POLLUTION CONTROL FACILITIES IN FISCAL YEARS 1971-76.

REPRINTED IN CONGRESSIONAL RECORD (SENATE), FEB 10, 1971, P S1266-S1273. FEB 1971. 9 P.

AN EXTENSIVE NATIONWIDE SURVEY WAS MADE IN 1970 OF THE CAPITAL REQUIREMENTS FOR CONSTRUCTING AND IMPROVING LOCAL WATER POLLUTION CONTROL FACILITIES DURING THE NEXT SIX YEARS. THIS INFORMATION WAS REQUESTED OF THE NATIONAL LEAGUE OF CITIES AND THE UNITED STATES CONFERENCE OF MAYORS BY SENATOR MUSKIE OF THE SENATE PUBLIC WORKS COMMITTEE. THE SURVEY COVERED 1,105 CITIES, COUNTIES AND INDEPENDENT SEWAGE TREATMENT AGENCIES SERVING A COMBINED POPULATION OF APPROXIMATELY 95 MILLION PERSONS. THESE COMMUNITIES IDENTIFIED NEEDS OF $21.7 BILLION. THE SURVEY ALSO ESTIMATED THAT, BASED ON A 5-PERCENT INFLATION FACTOR AND THE FACT THAT 45 TO 55 MILLION OF THOSE PERSONS SERVED BY SEWERS WERE NOT COVERED BY THE SURVEY, TOTAL NEEDS FOR PUBLIC EXPENDITURES FOR CLEAN WATER FACILITIES DURING THE NEXT FEW YEARS ARE IN THE RANGE OF $33 TO $37 BILLION. THE NEEDS WERE SEPARATED INTO THREE CATEGORIES IN THE MAILED SURVEY QUESTIONNAIRE. THE NEEDS REPORTED WERE AS FOLLOWS: (1) PRIMARY AND SECONDARY TREATMENT FACILITIES, $9,311,987,574; (2) TERTIARY TREATMENT FACILITIES, $4,100,386,533; (3) INTERCEPTOR AND STORM SEWER IMPROVEMENTS, $8,368,738,149. A SIGNIFICANT PORTION OF THE NEEDS REPORTED WERE FOR

INTERCEPTOR SEWERS WHICH ARE CURRENTLY ELIGIBLE FOR FEDERAL AID. TWO TABLES ARE INCLUDED WHICH LIST THE CAPITAL NEEDS IN EACH OF THE THREE CATEGORIES. ONE TABLE IS A LISTING BY STATES, AND THE OTHER A LISTING BY INDIVIDUAL JURISDICTIONS WITHIN STATES. (W71-07192).

00528. DESIGN AND OPERATING EXPERIENCES USING DIFFUSED AERATION FOR SLUDGE DIGESTION.

RITTER, L.E.
WATER POLLUTION CONTROL ASSOCIATION OF PENNSYLVANIA, 41ST ANNUAL CONFERENCE AEROBIC DIGESTION (1969). 17 P.

AEROBIC SLUDGE DIGESTION WAS STUDIED IN THREE PLANTS OF EASTERN PENNSYLVANIA. THE PROCESS REQUIRES 3 TO 5 CU FT DIGESTION VOLUME AND 1 SQ FT DRYING SPACE PER CAPITA, AND AERATION RATE OF 20 CFM PER 1000 CU FT OF DIGESTER CAPACITY. THE DIGESTION IS FREE FROM OBNOXIOUS ODORS. MANUAL DECANTING OF SUPERNATANT INCREASES PHOSPHATE CONCENTRATION IN THE EFFLUENT. CONCENTRATING SLUDGE PRIOR TO FEEDING INCREASES DESTRUCTION OF VOLATILE SOLIDS. ADDITION OF LIME AS A DRYING AID AND ALUMINUM SULFATE AS A COAGULANT INCREASES DRAINABILITY AND REDUCES TIME, BUT LEADS TO FORMATION OF CRUSTS OF CHEMICALS ON DRYING BEDS. OPERATING COSTS OF SLUDGE DIGESTION ARE PRESENTED. (W71-07358).

00529. COOLING TOWER FOG: CONTROL AND ABATEMENT.

VELDHUIZEN, H.; LEDBETTER, J.
JOURNAL OF THE AIR POLLUTION CONTROL ASSOCIATION, 21(1) 21-24, 1971.

FOGS FROM COOLING TOWERS ARE CAUSING AN INCREASING NUMBER OF VISIBILITY PROBLEMS IN ADDITION TO ICING OF ROADS, SIDEWALKS, POWERLINES, ETC. DURING FREEZING WEATHER. THIS PAPER SUMMARIZES A STUDY MADE TO ASCERTAIN THE BEST METHOD OF FOG CONTROL OR ABATEMENT AT A REFINERY IN HOUSTON, TEXAS. THE INDUCED DRAFT, COUNTERFLOW COOLING TOWERS OF CONCERN HAVE DESIGN CAPACTIES OF 750 MILLION AND 225 MILLION BTU/HR UNDER LOCAL CLIMATIC CONDITIONS. WHEREVER POSSIBLE, PRELIMINARY CAPITAL, INSTALLATION, AND OPERATING COSTS FOR ALL THE ALTERNATIVES WERE OBTAINED AND SUMMARIZED IN A TABLE. THE MOST ECONOMICAL SOLUTION FOR THIS PARTICULAR PROBLEM IS TO UNLOAD THE COOLING TOWER FOR THE ESTIMATED 750 HOURS A YEAR EITHER BY DISPOSING OF OR STORING THE HOT WATER. COMPLETE CONTROL BY ALTERING THE HEAT EXCHANGE MECHANISM IS POSSIBLE BUT THE COSTS ARE EXORBITANT. DRY TOWERS WHICH ARE BEING CONSIDERED TO PREVENT FOGGING, ARE VERY EXPENSIVE. FOR NEW COOLING TOWERS, ITS LOCATION IS RECOMMENDED AS A VERY IMPORTANT FACTOR. (W71-07437).

00530. COOLING TOWERS BOOST WATER REUSE.

ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 5(3), 204-206, 1971.

COOLING TOWERS ARE NOW WIDELY USED IN THE PETROLEUM AND PERTROCHEMICAL INDUSTRIES, ESPECIALLY WITH THE PRESENT DRIVE FOR THERMAL POLLUTION CONTROL. THE LARGEST MARKET FOR COOLING TOWERS IS ELECTRICAL PLANTS, AS THE ELECTRICAL POWER USE DOUBLES EVERY TEN YEARS. BRIEF DESCRIPTION IS GIVEN OF VARIOUS TYPES OF COOLING SYSTEMS, TOGETHER WITH COMPARISON OF THEIR ECONOMICAL AND ENVIRONMENTAL FEATURES. HYPERBOLIC TOWERS ARE BEING SCRUTINIZED FROM THE VIEWPOINT OF THEIR LARGE INITIAL COSTS AND LACK OF FUNCTIONAL EFFICIENCY IN THE UNITED STATES. COOLING TOWER PRICES RANGE FROM CHEAP MODELS (PLYWOOD, GALVANIZED STEEL HARDWARE) WHOSE COST IS ESTIMATED AT $5 PER GALLON, TO THE MORE EXPENSIVE ONES (SILICA-BRONZE, STAINLESS STEEL, ETC.) WHICH WILL COST $12-$13 PER GALLON OF RECYCLED WATER. WATER TREATMENT REQUIREMENTS ARE PRESENTED FROM THE VIEWPOINT OF THE FOUR COMMON OPERATIONAL PROBLEMS: CORROSION, SCALE, DEPOSITION FOULING AND MICROBIOLOGICAL ATTACK. (W71-07438).

00531. ANN ARBOR'S RECALCINING PROCESS AND PROBLEMS.

SCOTT, J.C.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 61(6), 285-288, 1969.

ALTHOUGH A COMPREHENSIVE REPORT ON ANN ARBOR'S WATER NEEDS SHOWED THAT THE LAGOONING OF LIME SLUDGE IS AN ADEQUATE DISPOSAL TECHNIQUE, THE DEVELOPMENT OF A LIME RECALCINING FACILITY WAS UNDERTAKEN. THE COST OF THE 24 TON PER DAY LIME RECLAMATION FACILITY IS ESTIMATED AT $1,200,000.00 INCLUDING HANDLING AND TREATMENT OF THE SLUDGE FROM THE CLARIFIER TO THE FINISHED LIME STORAGE TANKS. THE BASIC FORMAT IS OUTLINED OF THE PROCESS METHODOLOGY FROM THE LIME SLUDGE WITHDRAWAL TO A LIME PRODUCT. THE PROBLEMS ASSOCIATED WITH THIS INSTALLATION ARE THOSE ARISING FROM PERSONNEL REQUIREMENTS, TYPE OF OPERATION CHARACTERISTICS OF SLUDGE COLLECTED, WINTER EQUIPMENT MAINTENANCE, AND OTHER EQUIPMENT NEEDS. THE COST ESTIMATE IS SHOWN TO BE HIGHLY VARIABLE AND A STUDY OF THE PROPOSED SITE AND SURROUNDINGS, AMONG OTHER FACTORS, MUST BE CAREFULLY EVALUATED. THE PROBLEMS ARE RELATED TO CONSTRUCTION, MAINTENANCE, AND OPERATING COSTS. (W71-07460).

00532. PROTECTING OUR ENVIRONMENT AND NATURAL RESOURCES IN THE 1970'S.

KNEESE, ALLEN V.
RESOURCES FOR THE FUTURE, INC, WASHINGTON, D.C., REPRINT NO 88, AUGUST 1970.8 P.

THIS REPRINT OF A STATEMENT BEFORE THE HOUSE SUBCOMMITTEE OF THE COMMITTEE ON GOVERNMENT OPERATIONS EXAMINES ENVIRONMENTAL POLLUTION PROBLEMS FROM AN ECONOMIC PERSPECTIVE, AND OUTLINES A PROPOSED WATER POLLUTION CONTROL STRATEGY. THE INADEQUACY OF GOVERNMENTAL SUBSIDIES AND TECHNOLOGICAL FIXES INCREASES THE IMPORTANCE OF MANAGING THE ENVIRONMENT IN TERMS OF 'COMMON PROPERTY RESOURCES'. THE AUTHOR REJECTS EXISTING FEDERAL WATER POLLUTION CONTROL STRATEGY BASED ON MUNICIPAL WASTE TREATMENT GRANTS UNDER THE WATER POLLUTION CONTROL ACT OF 1956 AND STATE WATER QUALITY STANDARDS, IMPOSED BY THE WATER POLLUTION CONTROL ACT OF 1965. THE INADEQUACY OF THIS STRATEGY STEMS FROM (1) LAGGING APPROPRIATIONS, (2) INEFFECTIVE ENFORCEMENT, AND (3) POOR COORDINATION. INDUSTRIAL TAX INCENTIVES ARE ALSO REJECTED AS ECONOMICALLY INEFFECTIVE. AN EFFLUENT CHARGES SYSTEM, COUPLED WITH REGIONAL MANAGEMENT, IS ECONOMICALLY SUPERIOR TO OTHER PLANS BECAUSE (1) EFFLUENT CHARGES REQUIRE PAYMENT FOR RESOURCE USE, (2) SUBSIDIES PROVIDE NO INHERENT INCENTIVES, (3)SUBSIDIES BIAS TECHNIQUE SELECTION, AND (4) EFFLUENT CHARGES PRODUCE REVENUE. A NATIONAL EF-

FLUENT CHARGE WOULD AVOID LOCAL POLITICAL PRESSURES (W71a07495).

00533. ECONOMIC ANALYSIS OF SEWER SERVICE CHARGE FORMULAS.

JOHNSON, J.A.
LAND ECONOMICS, 47(1), 80-86. 1971.

THIS PAPER ANALYZES THE MOST IMPORTANT TYPES OF SEWER SERVICE CHARGE FORMULAS. IT JUDGES THESE SIX DIFFERENT TYPES IN TERMS OF EQUITY, ECONOMIC EFFICIENCY, REVENUE ADEQUACY, AND ADMINISTRATIVE SIMPLICITY. THE ADVANTAGES AND DISADVANTAGES OF EACH TYPE OF SYSTEM FOR DIFFERENT MUNICIPALITIES ARE DESCRIBED AND ANALYZED. (W71-07502

00534. FINAL REPORT OF THE TECHNICAL COMMITTEE ON STORM OVERFLOWS AND THE DISPOSAL OF STORM SEWAGE.

CALVERT, J.T.
INST CIVIL ENGRS (LONDON), 47, P 305-308, 1970.

AN INFORMAL DISCUSSION ON THE COMMITTEE'S FINDINGS SHOWS THAT (1) THE ABOLITION OF ALL STORM OVERFLOWS WAS NOT RECOMMENDED BECAUSE THE ENORMOUS COST COULD NOT BE JUSTIFIED AND POLLUTION FROM SURFACE WATER SEWERS COULD STILL OCCUR, AND (2) A NEW FORMULA, IN WHICH THE AMOUNT OF SEWAGE TO BE CONTAINED IN THE SYSTEM DOWNSTREAM OF THE OVERFLOW WOULD VARY ONLY SLIGHTLY WITH WATER CONSUMPTION AND THE FORMULA WOULD BROADLY ENSURE THE POLLUTING MATTER FROM EACH PERSON WAS DILUTED BY A FIXED AMOUNT OF RAINWATER BEFORE SPILL COMMENCED, WERE RECOMMENDED. (W71-07519).

00535. WASTE DISPOSAL AND POLLUTION, POULTRY PROCESSING.

RETRUM, R.
PROCEEDINGS OF THE CONFERENCE, 'AGRICULTRAL WASTE IN AN URBAN ENVIRONMENT,' NEW JERSEY ANIMAL WASTE DISPOSAL TASK FORCE, P 64-75, SEPT 14-17, 1970.

IT IS THE AUTHOR'S INTENTION TO ATTEMPT TO DEFINE THE PROBLEM OF WASTE DISPOSAL AND POLLUTION WITH RESPECT TO POULTRY PROCESSING, TO DESCRIBE EFFORTS NOW BEING MADE TOWARD SOLUTION, TO REVIEW COST EFFECTS, AND TO INDICATE PROMISING DIRECTIONS FOR ACCELERATED INVESTIGATION. THE PROBLEMS CONSIDERED AS THE MAJOR POLLUTION PROBLEMS ARE FEATHER LITTER, WATER POLLUTION, SEWAGE TREATMENT ODORS, AND RENDERING ODORS. COSTS AND OTHER DATA ARE COMPUTED FOR AN 80,000 BIRD PER DAY BROILER PROCESSING PLANT WITH A SMALL ASSOCIATED RENDERING PLANT. SUGGESTIONS ARE MADE FOR DECREASING THE TOTAL WASTE LOAD WHILE INCREASING INCOME. SYSTEMS FOR REDUCING THE ODOR FROM BOTH SEWAGE TREATMENT AND RENDERING PLANTS ARE EXPLAINED. THE ODOR PROBLEM IS COMPLEX AND THERE ARE NO PAT SOLUTIONS. ANY SOLUTION WILL BE EXPENSIVE. (W71-07553).

00536. CONSUMER ASSESSMENT OF WATER QUALITY AND THE COST OF IMPROVEMENTS.

BRUVOLD, W.H.; WARD, P.C.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 63, 3-5, 1971.

THIS PAPER ILLUSTRATES HOW A CONSUMER SURVEY COULD BE USED TO DOCUMENT THE NATURE AND EXTENT OF WATER QUALITY PROBLEMS AND HOW INFORMATION COULD BE OBTAINED FROM CONSUMERS REGARDING THEIR WILLINGNESS TO PAY FOR IMPROVEMENTS IN QUALITY. FURTHER, THE USE OF SUCH SURVEYS TO DEAL WITH FOUR GENERAL ISSUES INVOLVED IN IMPORVING WATER QUALITY WAS DISCUSSED. THE INTERVIEW SCHEDULE WAS PRESENTED. THE FINAL INSTRUMENT WAS DIVIDED INTO TWO MAIN PARTS: ONE DEALING WITH CONSUMER ASSESSMENT OF WATER QUALITY AND THE OTHER WITH THE COST OF THE LOCAL WATER, THE POSSIBLE NEED FOR IMPROVING WATER QUALITY, AND THE COST OF SUCH IMPROVEMENTS. TABULATED DATA INCLUDED STRUCTURE RATINGS FOR WATER IN GENERAL AND TASTE, REASONABLE AND HIGHEST INCREASE, AND WATER RATES. (W71-07738).

00537. 00576 COST AND MANPOWER FOR MUNICIPAL WASTE WATER TREATMENT PLANT OPERATION AND MAINTENANCE.

MICHEL, R.L.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42, 1883-1915, 1970.

AN ANALYSIS WAS MADE OF THE OPERATION AND MAINTENANCE EXPENDITURE AND MANPOWER REQUIREMENTS FOR WASTE WATER TREATMENT WORKS AS REPORTED FOR SOME 1,600 SUCH AUDITS DURING THE PERIOD JANUARY 1965 TO JUNE 1968. A STATISTICAL TEST (SIMPLE LINEAR CORRELATION) WAS USED TO DETERMINE THE TRENDS BETWEEN THE FOLLOWING COMBINATIONS OF VARIABLES: (1) TOTAL ANNUAL COST VS. AVERAGE FLOW RATE, (2) TOTAL ANNUAL COST VS. POPULATION EQUIVALENT LOAD, (3) ANNUAL LABOR COST VS. AVERAGE FLOW RATE, (4) ANNUAL LABOR COST VS. POPULATION EQUIVALENT LOAD, (5) ANNUAL ELECTRICITY COST VS. AVERAGE FLOW RATE, (6) ANNUAL ELECTRICITY COST VS. POPULATION EQUIVALENT LOAD, (7) ANNUAL CHEMICAL COST VS. AVERAGE FLOW RATE, (8) ANNUAL CHEMICAL COST VS. POPULATION EQUIVALENT LOAD, (9) TOTAL WEEKLY MAN-HOURS VS. AVERAGE FLOW RATE, (10) TOTAL WEEKLY MAN-HOURS VS. POPULATION EQUIVALENT LOAD. ALL THE RESULTS WERE PLOTTED ON FIGURES. IN GENERAL, THE COST PATTERNS DERIVED FROM THIS STUDY WERE VERY SIMILAR TO THOSE DERIVED FROM THE 1,500 REPORTS OF A DIFFERENT SET OF PLANTS AUDITED BETWEEN 1962 AND 1965. (W71-07743)

00538. ECONOMIC EVALUATION: ALTERNATIVES FOR INDUSTRIAL TREATMENT.

CAMIN, K.Q.
WATER AND SEWAGE WORKS, 116(7) IW/10 - IW/13, 1969.

WITH REDUCTION OF POLLUTION CONTENT AS THEIR GOAL, INDUSTRIES WHOSE MANUFACTURING PROCESSES GENERATE SUBSTANTIAL WASTELOADS USUALLY HAVE SEVERAL ALTERNATIVE SOLUTIONS. THIS PAPER DISCUSSED WHAT WASTE TREATMENT ALTERNATIVE WOULD GIVE A SPECIFIED AMOUNT OF WASTE REDUCTION AT MINIMUM COST. TO ILLUSTRATE THE THEORY AND METHOD OF EVALUATION, EMPHASIS WAS PLACED UPON 'MUNICIPAL WASTE TREATMENT' AND 'INDUSTRIAL WASTE TREATMENT.' IT INDICATED THAT A CHANGE IN

WASTELOAD (LB OF BOE) PER UNIT OF PRODUCT VARIED DIRECTLY WITH WASTE WATER VOLUME PER UNIT OF PRODUCT. COST FOR MUNICIPAL TREATMENT AND INDUSTRIAL TREATMENT WERE DISCUSSED RESPECTIVELY. FOR MEANINGFUL COMPARISON ALL COST STREAMS WERE CONVERTED INTO PRESENT VALUE. IT WAS NOTED THAT THE OPTIMAL CHOICE WOULD CHANGE IF THE DISCOUNT RATE OR THE TIME HORIZON WERE DIFFEEENT. (W71-07752).

00539. RENOVATION OF MUNICIPAL WASTE WATER BY REVERSE OSMOSIS.

SMITH, J.M.; MASSE, A.N.; MIELE, R.P.
EPA REPORT 17040--05/70, MAY 1970. 59 P.

THE THREE MAJOR CONFIGURATIONS OF REVERSE OSMOSIS UNITS INCLUDE SPIRAL WOUND UNITS, TUBULAR UNITS, AND PLATE AND FRAME UNITS. TESTS WERE CONDUCTED ON PROTOTYPE UNITS EMPLOYING ALL THREE CONFIGURATIONS, AND THE MEMBRANES WERE FOUND CAPABLE OF REJECTING 93 TO 95% OF TDS, 90 TO 99% OF PHOSPHATES, 80 TO 90% OF AMMONIA NITROGEN, 60 TO 70% OF NITRATE NITROGEN, 99 TO 100% OF PARTICULATE MATTER, 90 TO 95% OF TOC AND GREATER THAN 90% OF COD. MANY OF THE PROBLEMS DISCOVERED STEMMED FROM THE USE OF PROTOTYPE UNITS WHICH HAD NOT BEEN THOROUGHLY TESTED AND WERE SUBJECT TO REPEATED MECHANICAL FAILURES. FOULING PROBLEMS HAVE BEEN PARTIALLY ALLEVIATED BY PERIODICALLY DEPRESSURIZING THE MEMBRANES AND WASHING THEM WITH ENZYME DETERGENTS. THE SUCCESS OF THIS METHOD IS ATTRIBUTED TO PROTEIN HYDROLYSIS OF THE SLIME LAYER WHICH COATS THE MEMBRANE. INCREASING POPULATION HAS DICTATED THE RECYCLING OF A MUCH LARGER PORTION OF THE NATION'S WATER. EACH TIME IT IS RE-USED, THE WATER PICKS UP GREATER AMOUNTS OF DISSOLVED SOLIDS. THESE SOLIDS WILL EVENTUALLY HAVE TO BE REMOVED TO PRESERVE THE POTABILITY OF DRINKING WATER. AT PRESENT, REVERSE OSMOSIS TECHNIQUES ARE THE MOST PROMISING METHODS FOR DISSOLVED SOLIDS REMOVALS. ALSO, INCREASING ADVANCES IN MEMBRANE MATERIALS HAVE STEADILY DECREASED THE COST OF REVERSE OSMOSIS TO THE POINT THAT A REVERSE OSMOSIS SYSTEM COUPLED WITH PRIMARY AND SAND FILTRATION ONLY HAS AN ESTIMATED COST OF 35.4 CENTS/1000 GALLONS. THIS FIGURE IS EQUAL TO THE COST OF CONVENTIONAL ACTIVATED SLUDGE TREATMENT PLUS FILTRATION AND CARBON ADSORPTION. (PB-199 067) (W71-07756).

00540. CANNERY WASTE TREATMENT - KEHR ACTIVATED SLUDGE.

FISHER, R.A.
EPA REPORT 12060EZP--09/70. 67 P.

THE KEHR MODIFICATION OF THE ACTIVATED SLUDGE PROCESS USES A COMPLETELY MIXED AERATION TANK WITH NO INTENTIONAL SOLIDS WASTING. AFTER THE AERATION TANK STABILIZED AT BETWEEN 4000 AND 12,000 MG/L OF MLSS, A 40 DAY INVESTIGATION USING MUNICIPAL AND CANNERY WASTES OF STRENGTHS FROM 200 TO 2000 MG/L BOD5 WAS CONDUCTED. 90% BOD5 AND 80% TOO REDUCTIONS WERE ACHIEVED, BUT LITTLE OR NO REDUCTION WAS DETECTED IN NITRATES AND PHOSPHATES AND THE EFFLUENT WAS COLORED AND TURBID. PERIODS OF LITTLE OR NO LOADING FOR AS LONG AS 48 HOURS CAUSED NO DECREASE IN TREATMENT EFFICIENCY WHEN FLOW WAS RESUMED. FROM THE ABOVE INFORMATION, KASP WAS RECOGNIZED AS BEING WELL SUITED TO INDUSTRIAL WASTE PRE-TREATMENT PRIOR TO DISCHARGE TO A MUNICIPAL TREATMENT PLANT. THE ABILITY TO HANDLE INTERMITTENT FLOWS, PROVIDE 90% BOD5 REMOVAL, AND PROVIDE AEROBIC DIGESTION OF SOLIDS IN THE AERATION TANK IS ESSENTIAL FOR PRE-TREATMENT DEVICES AND ALL ARE POSSESSED BY KASP. EXCLUSIVE OF PRIMARY TREATMENT, TREATMENT OF 10 MGD OF A 250 MG/L BOD5 WASTE WOULD COST 7 CENTS/1000 GALLONS USING GRAVITY SETTLING. BECAUSE OF OPERATIONAL PROBLEMS AND HIGH POWER DEMAND, THE USE OF THE ELECTROFLOTATION INSTEAD OF GRAVITY SETTLING WOULD INCREASE COSTS TO 29 CENTS/1000 GALLONS TREATED. IN EACH INSTANCE, HOWEVER, THE VARIABILITY OF INDUSTRIAL WASTES DEMANDS PILOT PLANT STUDIES TO DETERMINE ACTUAL DESIGN CRITERIA AND COST ESTIMATES (PB-199 071) (W71-07757).

00541. TREATMENT OF SOLE LEATHER VEGETABLE TANNERY WASTES.

EYE, J.D.
EPA REPORT 12120--09/70, SEPT 1970.

A THREE YEAR STUDY WAS CONDUCTED TO DETERMINE THE FEASIBILITY OF TREATING TANNERY WASTES BIOLOGICALLY. A PILOT PLANT WAS OPERATED FIRST TO DETERMINE THE DESIGN PARAMETERS, AFTER WHICH A FULL SCALE SYSTEM WAS CONSTRUCTED. THE FULL SCALE SYSTEM CONSISTED OF SPECIALIZED PRE-TREATMENT OF SEGREGATED WASTE STREAMS, PRIMARY CLARIFICATION, AND AN ANAEROBIC-AEROBIC LAGOON SYSTEM. 10 MG/L OF ANIONIC POLYELECTROLYTE WAS ADDED TO THE PRIMARY CLARIFIER TO ENHANCE SETTLING. AT CLARIFIER OVERFLOW RATES RANGING FROM 1600 TO 2500 GPD/SQ FT, 80 TO 90% REMOVAL OF SUSPENDED LIME PARTICLES WAS OBTAINED. LOADING ON THE LAGOONS RANGED FROM 2-20 LBS BOD/DAY/1000 CU FT WITH REMOVALS RANGING FROM 80 TO 95% EXCEPT DURING COLD WEATHER, WHEN REMOVALS IN THE 65-75% RANGE WERE OBSERVED. ODORS EMANATING FROM THE LAGOONS WERE EFFECTIVELY CONTROLLED THROUGH THE ADDITION OF SPENT VEGETABLE TAN LIQUORS. FOAMING PROBLEMS WERE SOLVED THROUGH USE OF HIGH PRESSURE NOZZLES. HOWEVER, THESE NOZZLES COULD NOT BE USED WHEN THE TEMPERATURE WAS BELOW FREEZING. THE MAIN CONCERN OF TANNERIES SHOULD BE DIRECTED TOWARDS WASTE FLOW MINIMIZATION AND PRETREATMENT. 70% OF THE POLLUTIONAL LOAD IS PRESENT IN 30% OF THE WASTE VOLUME. EDUCATION OF OPERATING PERSONNEL IS OF PRIME IMPORTANCE IN REDUCING FLOWS TO REDUCE COSTS. THE TOTAL COST OF THE SYSTEMS AS INSTALLED AT MARLINTON WAS $40,000, WITH OPERATING COSTS AVERAGING $15,000/YEAR OR $. 07/HIDE PROCESSED WITH A FLOW OF 1 MILLION GALLONS/WEEK. FURTHER, WORK IS NECESSARY IN COLOR REMOVAL AND DISINFECTION. STUDIES ON COMBINED TREATMENT OF MUNICIPAL AND TANNERY WASTES ARE ALSO NEEDED SINCE BOTH THE TANNERY AND MUNICIPALITY COULD CONCEIVABLY BENEFIT FROM SUCH AN ARRANGEMENT. (PB-199 068) (W71-07758).

00542. PHENOLIC WASTE RE-USE BY DIATOMITE FILTRATION.

MERRILL, E.I.
EPA REPORT 12080 EZF--09/70, SEPT 1970. 125 P.

FIBERGLASS PRODUCTION INVOLVES THE USE OF AN EXPENSIVE PHENOLIC RESIN. A 28 MONTH STUDY WAS CONDUCTED TO DETERMINE THE FEASIBILITY OF RECLAIMING WATERS WHICH HAD BEEN USED FOR WASHING RESINS OFF OF CONVEYOR LINES TO PREVENT FOULING. THE SYSTEM DEVELOPED REDUCES WATER CONSUMPTION BY UTILIZING AN 8 GPM, 1000 PSI SPRAY CLEANER. AFTER THE CONVEYORS ARE WASHED, THE WATER FLOWS THROUGH TWO STAGES OF SCREENING, OR PRIMARY FILTRATION, AND A SECONDARY DIATOMITE FILTRATION UNIT. SINCE MOST OF THE SOLIDS ARE LARGE, THE

DIATOMITE FILTERS ACCOMPLISH THE REMOVAL OF ONLY . 6% OF THE TOTAL SOLIDS LOAD, WITH THE MAJOR REMOVALS TAKING PLACE AT THE PRE-SCREENING EQUIPMENT. THE WATER RE-USE SYSTEM WILL USE THE SAME WATER 4-5 TIMES BEFORE IT IS COMPLETELY EVAPORATED, REQUIRING 1 LB OF DIATOMITE/500 GALLONS OF WATER FILTERED. THE SYSTEM PROVIDES WATER AT A NET COST OF $. 37/1000 GALLONS AS COMPARED TO $. 75/1000 GALLONS FOR CITY WATER. SUBSTANTIAL OPERATIONAL SAVINGS HAVE BEEN REALIZED THROUGH CONSERVATION OF THE EXPENSIVE PHENOLIC BINDER. A NET'BEFORE TAX' INCOME RETURN OF 9.5% HAS BEEN OBTAINED ON THE APPROXIMATELY $165,000 INVESTED. IN ADDITION, WASTE PHENOLIC DISCHARGES HAVE DROPPED 80%, SUSPENDED SOLIDS HAVE DECREASED 83%, AND DISSOLVED SOLIDS HAVE DECREASED BY 50%. IN THIS INSTANCE, THEREFORE, WASTE DISCHARGE CONTROL HAS BOTH PROTECTED THE ENVIRONMENT AND PROFITED THE INDUSTRY. (PB-199 069) (W71-07759).

00543. TREATMENT TECHNIQUES FOR REMOVING PHOSPHORUS FROM MUNICIPAL WASTE WATERS.

CONVERY, J.J.
EPA REPORT 17010--01-70, JAN 1970. 35 P.

BIOLOGICAL UPTAKE, CHEMICAL PRECIPITATION OF SOLUBLE PHOSPHORUS, AND SETTLING OR FILTRATION OF PARTICULATE PHOSPHORUS ARE THE MAJOR REMOVAL MECHANISMS USED IN PHOSPHORUS REMOVAL. AT PRESENT, CHEMICAL PRECIPITATION IS THE MOST UNIVERSALLY APPLIED METHOD. THE WIDE VARIETY OF CHEMICAL REACTIONS WHICH LEAD TO PHOSPHORUS PRECIPITATION ALLOWS MUCH FLEXIBILITY OF OPERATION TO PLANT OPERATORS. IN DEALING WITH RAW SEWAGE, PRIMARY EFFLUENT, OR SECONDARY EFFLUENT THE SIZE OF THE PLANT, INFLUENT WASTE WATER CHARACTERISTICS, PHOSPHORUS DISCHARGE STANDARD, AND THE TYPES OF OTHER PROCESSES USED IN THE TREATMENT TRAIN MUST ALL BE CONSIDERED. IN ADDITION TO PHOSPHORUS REMOVAL, HIGHER LEVELS OF BOD AND SUSPENDED SOLIDS REMOVALS ARE CUSTOMARILY OBTAINED WHEN SOME TYPE OF PHOSPHATE REDUCTION MECHANISM IS EMPLOYED. EACH OF THE MECHANISMS DESCRIBED HERE HAVE BEEN ANALYZED BOTH WITH RESPECT TO TECHNOLOGICAL AND ECONOMIC FEASIBILITY. COSTS RANGED FROM 13 CENTS /1000 GALLONS FOR TWO-STAGE LIME TREATMENT OF 1 MGD TO ACHIEVE 97% REMOVAL, TO A POTENTIAL LOW OF $. 015/1000 GALLONS USING WASTE PICKLE LIQUOR TO ACHIEVE REDUCTION OF 80%. (PB-199 072) (W71-07760).

00544. FLOW REDUCTION OF WASTE WATER FROM HOUSEHOLDS.

BAILEY, J.; WALLMAN, H.
WATER AND SEWAGE WORKS, 118(3), 68-70, MAR 1971.

VARIOUS SOURCES WERE UTILIZED TO ESTABLISH A WATER USE PATTERN FOR AN AVERAGE AMERICAN FAMILY OF 2 ADULTS AND 2 CHILDREN. 70% OF THE TOTAL HOUSEHOLD WATER INTAKE IS CONSUMED IN TOILET FLUSHING AND BATHING. THEREFORE, SINCE THIS IS THE LARGEST SINGLE AREA OF WATER USE, THE GREATEST SAVINGS FROM APPLIED CONSERVATION TECHNIQUES SHOULD BE ACCOMPLISHED HERE. SEVERAL PLUMBING INNOVATIONS THAT REDUCE THE AMOUNT OF WATER REQUIRED TO TRANSPORT WASTE PRODUCTS FROM THE HOME ARE PRESENTED, AS WELL AS WATER-CONSERVING DEVICES FOR SHOWERS AND WASHING MACHINES. A COST ANALYSIS REVEALED, HOWEVER, THAT WATER RE-USE WITHIN THE INDIVIDUAL HOME UNIT IS NOT ECONOMICALLY FEASIBLE. WATER CONSERVATION, THEN, IS IMPORTANT IN REDUCING THE TOTAL VOLUME OF FLOW WHICH REQUIRES EXTENSIVE TREATMENT, THEREBY EASING THE BURDEN ON MANY OVERLOADED TREATMENT FACILITIES. THE FOLLOWING CONCLUSIONS WERE DRAWN FROM THE PRECEDING STUDY: (1) CURRENTLY AVAILABLE WATER SAVING DEVICES CAN REDUCE WASTE FLOWS FROM 30 TO 50% AT LITTLE ADDITIONAL COST TO THE HOMEOWNER: (2) LIMITED SURVEYS INDICATE GENERAL PUBLIC ACCEPTANCE OF SUCH DEVICES: AND (3) COMPLETE WASTE TREATMENT AND WATER RE-USE ON A SINGLE UNIT SCALE DOES NOT APPEAR TO BE PRACTICAL AT THIS TIME. (W71-07777).

00545. CATCH BASINS CLEANED FOR $3.00.

PUBLIC WORKS, 101(8), 81, AUG 1970.

TEANECK, NEW JERSEY'S SWITCH FROM BUCKET CLEANING OF CATCHBASINS TO SUCTION CLEANING WITH A GOOD ROADS SCAVENGER HAS REDUCED COSTS OF THE TWICE-A-YEAR JOB BY 80%. THE RATE OF CATCHBASIN CLEANING HAS ALSO INCREASED CONSIDERABLY. THE SUCTION MACHINE IS ALSO USED TO CLEAN OUT MANHOLES, TO CLEAN STREETS, AND TO PICKUP AND DISPOSE OF LEAVES ON STREETS AND PARK GROUNDS DURING AUTUMN. (W71-07856).

00546. STORM SEWER ASSESSMENTS.

DAGUE, R.R.
PUBLIC WORKS, 101(8), 62-66, 118, 1970.

THE AUTHOR PRESENTS A METHOD OF STORM SEWER ASSESSMENT WHICH WAS APPLIED TO A PROJECT IN DES MOINES, IOWA. FOUR BENEFIT FACTORS CONSIDERED IN APPORTIONING PROPERTY COSTS CAN BE UTILIZED IN STORM SEWER ASSESSMENT IF THE RELATIVE WEIGHT OF EACH FACTOR IS DETERMINED BY THE RELATIVE BENEFIT TO BE ACCRUED. OTHER FACTORS TO BE CONSIDERED REFLECTING COSTS AND THEREFORE BENEFIT ARE; (1) THE AREA DRAINED, (2) THE RUNOFF COEFFICIENT, (3) THE RAINFALL INTENSITY, (4) THE DISTANCE TO THE OUTLET, (5) THE UNIT PIPE COST, AND (6) THE SLOPE OF THE SEWER. EACH OF THESE FACTORS IS DISCUSSED IN RELATION TO A SUB-AREA. ONCE THE DOLLAR BENEFIT TO EACH SUB-AREA IS DETERMINED, THE BENEFIT TO INDIVIDUAL PROPERTIES WITHIN SUB-AREAS MUST BE ASCERTAINED. ALSO, IN ARRIVING AT STORM SEWER ASSESSMENT, THE BENEFIT ACCRUING TO PUBLIC PROPERTY MUST BE CONSIDERED. MEANS FOR EVALUATING ALL OF THESE FACTORS ARE THOROUGHLY DESCRIBED. THE DES MOINES PROCEDURE OUTLINED IN THIS ARTICLE DOES NOT NECESSARILY HAVE APPLICATION TO ALL STORM SEWER SPECIAL ASSESSMENT PROBLEMS. THE TEST OF THE METHOD WILL COME THROUGH ITS APPLICATION TO A VARIETY OF STORM SEWER ASSESSMENT PROBLEMS ALONG WITH SUCCESS IN THE COURTS. (W71-07863).

00547. THIRTY-SEVEN BILLION: NEW PRICE TAG FOR CITIES' WATER POLLUTION CONTROL COSTS.

NATION'S CITIES, 8(8), 8-9, 1970.

THE NATIONAL LEAGUE OF CITIES (NLC) AND THE UNITED STATES CONFERENCE OF MAYORS (USCM) ESTIMATED BETWEEN $33 BILLION AND $37 BILLION WILL BE NEEDED TO COMBAT WATER POLLUTION BETWEEN 1970 AND 1976, AS REPORTED BY SENATOR MUSKIE, IN COMPARISON WITH FWQA REPORTS OF $10 BILLION OVER THE FIVE YEAR SPAN, 1970-1974. THE NLC-USCM SURVEY ASKED FOR SPECIFIC COST DATA CATEGORIZED IN THE FOLLOWING MANNER: (1) NEEDS FOR PRIMARY AND SECONDARY TREATMENT FACILITIES, (2) NEEDS FOR TERTIARY TREAT-

MENT FACILITIES; AND (3) NEEDS FOR INTERCEPTOR AND STORM SEWERS, INCLUDING PROJECTED COSTS OF SEPARATING STORM AND SANITARY SEWERS, AND/OR STORING STORM WATER OVERFLOWS. THE SURVEY COVERED 1,008 COMMUNITIES WITH A COMBINED POPULATION OF APPROXIMATELY 89.4 MILLION. BASED ON THE PROJECTION FROM THIS SURVEY, THE NLC AND USCM ESTIMATED THE TOTAL NATIONAL NEEDS FOR STATE AND LOCAL WATER POLLUTION CONTROL FACILITIES FOR THE NEXT SIX YEARS WHICH INCLUDES A FIVE PERCENT INFLATION FACTOR. DISCUSSION ON PAST, PRESENT, AND FUTURE LEGISLATIVE ACTION IS INCLUDED, AND A COST CHART BASED ON SURVEY RESULTS IS GIVEN. (W71-07867).

00548. INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL I, SECTION A.

DAVID, E.L.; DAVIS, P.N.; FOX, I.K.; DORSEY, A.H.J.; FAULKNER, C.H.
OWRR TECHNICAL REPORT, 1971. 165 P.

A CASE STUDY WAS MADE TO DETERMINE LEAST-COST SYSTEMS FOR ACHIEVING SPECIFIC WATER QUALITY LEVELS OF THE WISCONSIN RIVER BASIN (WISCONSIN). TO INITIATE LEAST-COST SYSTEMS, INSTITUTIONAL PREREQUISITES WERE ANALYZED AND ALTERNATIVE INSTITUTIONAL STRUCTURES CONSIDERED. BY APPLICATION OF A PREDICTIVE WATER QUALITY MODEL BASED ON DISSOLVED OXYGEN AND ANALYSIS OF COSTS INFLUENCING DO LEVELS, COSTS OF SYSTEMS TO MEET SPECIFIED OBJECTIVES ARE DETERMINED INDICATING THAT SUBSTANTIAL ECONOMIES CAN BE REALIZED BY UTILIZATION OF A REGIONAL MANAGEMENT SYSTEM. ALTERNATIVE POLICIES AND ORGANIZATIONAL ARRANGEMENTS ARE ASSESSED. POTENTIAL AND EQUITABLE ECONOMIES COULD BE REALIZED WITH SUBSTANTIAL CHANGES IN POLICY FRAMEWORK; AN EFFLUENT-CHARGE SYSTEM WOULD PROVE UNNECESSARILY COSTLY AND ITS ADMINISTRATION DIFFICULT; EFFECTIVE RESULTS CAN BE ACHIEVED BY A COMBINATION OF REGULATION AND COST SHARING OF SYSTEM MANAGEMENT BY WASTE PRODUCERS. CRITERIA OF ORGANIZATIONAL DESIGN ARE ESTABLISHED AND APPLIED TO THREE ALTERNATIVE ORGANIZATIONAL ARRANGEMENTS. AN ORGANIZATIONAL SYSTEM INCLUDING A QUASI-JUDICIAL BODY (TO ESTABLISH STANDARDS), A STATE WATER RESOURCES AGENCY (TO MONITOR ENVIRONMENTAL INTERESTS), AND A REGIONAL IMPLEMENTING AND OPERATING AGENCY WOULD MOST EFFECTIVELY MEET THE DESIRED CRITERIA. (PB-199 268) (W71-07972).

00549. COMBINED SEWER OVERFLOW SEMINAR PAPERS.

PAPERS PRESENTED AT SEMINAR AT HUDSON-DELAWARE BASINS OFFICE, EDISON, NJ, NOV 4-5, 1969, WATER POLLUTION CONTROL RESEARCH SERIES DAST-37, MAR 1970, 199 P.

A LARGE NUMBER OF CITIES STILL HAVE COMBINED SANITARY AND STORM WATER SEWERS. DURING STORMS, THE OVERFLOW FROM THESE SEWERS PASSES DIRECTLY TO THE RECEIVING WATERS, SINCE THE VOLUME IS TOO GREAT FOR THE TREATMENT PLANT TO HANDLE. THE EVER-PRESENT EMPHASIS ON POLLUTION HAS FOCUSED MUCH ATTENTION ON NOT ONLY COMBINED SEWERS, BUT ON UNTREATED STORM WATER FROM SEGREGATED SEWERS AS WELL. IN FALLING THROUGH THE ATMOSPHERE, AND IN WASHING DOWN BUILDINGS AND STREETS WHICH ARE COVERED WITH ORGANIC POLLUTION, THE STORM WATERS BECOME NEARLY AS POLLUTED AS SANITARY FLOWS, AND OFTEN TIMES MORE SO. ALL OF THE PAPERS PRESENTED AT THE CONFERENCE ARE CONCERNED SPECIFICALLY WITH THE ABATEMENT OF POLLUTION STEMMING FROM THE USE OF COMBINED SEWERS. HOWEVER, RATHER THAN REPORTING ON METHODS OF CHANGING THE SEWER SYSTEMS, MOST RESEARCH BEING DONE CALLS FOR TREATING BOTH FLOWS ANYWAY. METHODS DISCUSSED RANGE FROM MICROSTRAINING TO AIR FLOTATION TO TUNNELS FOR STORAGE BEFORE SUBSEQUENT SEA DISPOSAL. COMBINED SEWER WASTES CAN BE TREATED AT COSTS REPORTED HERE RANGING FROM 4 CENTS TO 29 CENTS PER 1000 GALLONS. FROM THESE REPORTS AND INVESTIGATIONS IT BECOMES APPARENT THAT THE TECHNOLOGY TO CLEAN UP STORMWATER POLLUTION IS AVAILABLE. THE ONLY THING LACKING IS ITS IMPLEMENTATION. (PB 199 361) W71-07978).

00550. MICROSTRAINING WITH OZONATION OR CHLORINATION OF COMBINED SEWER OVERFLOWS.

KEILBAUGH, W.A.; GLOVER, G.E.; YATSUK, P.M.
COMBINED SEWER OVERFLOW SEMINAR PAPERS, P 59-99, MAR 1970.

MICROSTRAINING HAS BEEN INVESTIGATED AS A POSSIBLE TREATMENT METHOD FOR STORMWATER OVERFLOWS FROM COMBINED SEWER SYSTEMS. SUSPENDED SOLIDS REMOVALS RANGED ROM 78% TO 98%, WITH 80% THE AVERAGE. VOLATILE SUSPENDED SOLIDS REMOVALS WERE DIRECTLY CORRELATED WITH SUSPENDED SOLIDS. BOD, ON THE OTHER HAND, ACTUALLY INCRRE: (1) NATURAL PREDATORS OF THE BACTERIA ARE REMOVED BY THE SCREEN; (2) LARGE BEASED IN 8 TO 17 MEASUREMENTS. THREE POSSIBLE EXPLANATIONS OF THESE PHENOMENA AACTERIAL COLONIES ARE SUBDIVIDED INTO LARGER NUMBERS BY STRAINING; (3) THE SCREENING PROCESS MAKES THE BACTERIAL FOOD SUPPLY MORE AVAILABLE. THE LAST EXPLANATION SEEMED MOST LIKELY. ALSO, INCREASED OXIDATION AT THE POINT OF ENTRY WILL CAUSE DOWNSTREAM EFFECTS TO BE LESS PERSISTENT. FURTHER RESEARCH IS NEEDED TO DETERMINE THE EFFECTS OF USING A STILL HIGHER DIFFERENTIAL HEAD. AT THIS TIME, NO OPERATIONAL PROBLEMS HAVE DEVELOPED. A COST ANALYSIS SHOWS BARSCREENING, MICROSTRAINING AND CHLORINATION TO COST FROM $10,500 TO $12,800 PER ACRE OF AREA SERVED. THE COST OF CONSTRUCTION OF SEPARATED SEWERS ALONE WAS ESTIMATED TO BE BETWEEN $20,000 TO $23,000 PER ACRE. SINCE STORM WATER, BECAUSE OF SUSPENDED AND DISSOLVED SOLIDS PICKED UP FROM STREET, HOUSES, AND THE ATMOSPHERE, HAS COME TO BE REGARDED AS A POLLUTANT IN ITSELF, THE SEGREGATED SEWERS HAVE LITTLE OR NO VALUE. THEREFORE, DEVELOPMENT AND REFINEMENT OF THE MICROSTRAINING TECHNIQUES SHOULD LEAD TO WIDESPREAD APPLICATIONS IN BOTH COMBINED AND SEPARATED SEWER SYSTEMS. (W71-07983).

00551. ASSESSMENT OF ALTERNATIVE METHODS FOR CONTROL/TREATMENT OF COMBINED SEWER OVERFLOWS FOR WASHINGTON, D.C.

DEFILIPPI, J.A.
COMBINED SEWER OVERFLOW SEMINAR PAPERS, P 123-138, MAR 1970.

DURING PERIODS OF HEAVY RAINFALL, SEWER SYSTEMS COLLECTING BOTH SANITARY WASTES AND STORMWATER OVERLOAD THE TREATMENT PLANT CAPACITY AND CAUSE THE DIRECT DISCHARGE OF AN ESTIMATED 9.5 MILLION LBS OF BOD, 224 MILLION LBS OF SUSPENDED SOLIDS, 3.5 MILLION LBS OF TOTAL PHOSPHATES, AND 1.0 MILLION LBS OF TOTAL NITROGEN TO RECEIVING WATERS

IN THE DISTRICT OF COLUMBIA. THESE ESTIMATES WERE OBTAINED FROM EXTENSIVE SAMPLING STUDIES PERFORMED AT THREE MONITORING INSTALLATIONS IN THE DISTRICT OF COLUMBIA DURING 1969. THE STUDIES WERE PERFORMED TO DETERMINE THE CHARACTERISTICS OF STORMWATER RUN-OFF, BOTH IN SEGREGATED SEWERS AND COMBINED SEWERS. RESULTS INDICATED THAT SIGNIFICANT POLLUTIONAL LOADS ARE DISCHARGED FROM BOTH TYPES OF SEWERS. FOUR ALTERNATIVE METHODS OF ABATING THE POLLUTION FROM STORMWATER RUN-OFF INCLUDE: (1) SEWER SEPARATION; (2) OFF-SYSTEM STORAGE; (3) IN-LINE TREATMENT, AND (4) MISCELLANEOUS. HOWEVER, BASED ON THE INITIAL SAMPLINGS SEPARATION WAS RULED OUT. THE REMAINING METHODS WERE ANALYZED ACCORDING TO THE OVERALL REQUIREMENTS FOR THE ENTIRE AREA. FINAL COSTS ESTIMATES ARE NOT YET AVAILABLE, BUT THESE STUDIES HAVE DEMONSTRATED THE FEASIBILITY OF THE REGIONAL SEWERAGE PLANT IN THIS INSTANCE. (W71-07986).

00552. MIDDLE LEE SETS THE STANDARDS.

BEAUMONT, P.
SURVEYOR, 136 (4075), 45-46, 1970.

NEW TOWN DEVELOPMENT IN THE LEE VALLEY CAUSED GREAT CONCERN THAT THE ALREADY OVERLOADED RIVER LEE WOULD DETERIORATE FURTHER AND BECOME MERELY AN OPEN SEWER. THIS PROBLEM WAS ESPECIALLY IMPORTANT BECAUSE THE RIVER LEE EMPTIES INTO THE CHINGFORD RESERVOIR, WHICH SUPPLIES 19% OF THE WATER SUPPLY OF METROPOLITAN LONDON. FINAL EFFLUENT STANDARDS SET IN 1955 REQUIRED THAT THE EFFLUENT CONTAIN LESS THAN 5 MG/L SS IN SUMMER, AND 10 MG/L SS IN WINTER, AND A FREE AMMONIA CONTENT OF LESS THAN 10 MG/L UNDER BOTH SUMMER AND WINTER CONDITIONS. CONSTRUCTION WAS ACCOMPLISHED IN THREE STAGES, THE FIRST STAGE HAVING A CAPACITY FOR 8 MGD. STAGE 2 WAS OF THE SAME SIZE AS STATE 1. HOWEVER, THE PLANT CAPACITY HAD TO BE REDESIGNED BEFORE COMPLETION OF STATE 2. THE FINAL CAPACITY OF THE FINISHED PLANT WAS SET AT 30 MGD TO COMPENSATE FOR RAPID POPULATION GROWTH. THE TREATMENT WORKS CONSISTED OF SCREENING, MACERATION, GRIT REMOVAL, AND PRIMARY SEDIMENTATION. SECONDARY TREATMENT OF ACTIVATED SLUDGE USING DIFFUSED AIR WAS PROVIDED, AND TERTIARY TREATMENT WAS ASSIGNED TO RAPID GRAVITY SAND FILTERS. PRIMARY AND SECONDARY SLUDGE IS DIGESTED ANAEROBICALLY, AND THE SLUDGE IS DISTRIBUTED FREE AS A TOP DRESSING OR SOIL CONDITIONER. TOTAL PLANT COST WAS ESTIMATED AT 6 MILLION POUNDS STERLING. WATER QUALITY RAPIDLY IMPROVED AFTER THE NEW PLANT WAS PUT INTO OPERATION, MORE THAN JUSTIFYING THE INVESTMENT. (W71-07995).

00553. WASTE WATER TREATMENT IN GREAT BRITAIN.

GRANT, R.J.
WATER AND SEWAGE WORKS, 117(8), 266-270, 1970.

65% OF THE DOMESTIC SEWAGE OF GREAT BRITAIN IS TREATED AND DISCHARGED TO INLAND WATER COURSES, WHILE THE REMAINING 35% IS DISCHARGED DIRECTLY TO ESTUARIES OR THE SEA, RECEIVING LITTLE OR NO TREATMENT. ANALYTICAL TESTS PERFORMED ARE THOSE RECOMMENDED IN 'STANDARD METHODS', WITH FEW EXCEPTIONS. WASTE WATER CONSTITUENTS OF BRITAIN'S DOMESTIC SEWAGE DIFFER FROM THOSE OF THE UNITED STATES, BECAUSE OF THE DIFFERENCE IN DIET. ACTIVATED SLUDGE, PASVEER OXIDATION DITCHES, AND LOW RATE TRICKLING FILTERS COMPRISE THE BULK OF THE WIDELY ACCEPTED SECONDARY TREATMENT METHODS. TERTIARY TREATMENT METHODS INCLUDE MICROSTRAINING, SLOW AND RAPID GRAVITY SAND FILTRATION, LAND IRRIGATION, LAGOONING AND UPFLOW PEBBLE BED CLARIFIERS, WHILE FLOCCULATION, FOAMING, ADSORPTION, REVERSE OSMOSIS, AND ELECTROLYSIS ARE IN THE EXPERIMENTAL STAGE. SLUDGE TREATMENT HAS TRADITIONALLY BEEN ACCOMPLISHED WITH DRYING BEDS. LACK OF LAND HAS STIMULATED MUCH INTEREST IN MECHANICAL DEWATERING DEVICES, NAMELY PRESSURE OR VACUUM FILTRATION, POLYELECTROLYTE CONDITIONING, HEAT TREATMENT, AND WET OXIDATION, AND INCINERATION. PROBLEMS ASSOCIATED WITH WASTE WATER TREATMENT ARE NOT EXPERIENCING THE SAME RAPID SOLUTIONS AS OTHER TECHNOLOGICAL PROBLEMS. MORE EFFECTIVE CONTROL AND RECLAMATION PRACTICES ARE NEEDED TO AVOID SERIOUS ENVIRONMENTAL PROBLEMS, AND PROGRESS WHICH HAS BEEN SLOW UP TO NOW MUST BEGIN TO SPEED UP IF THE ENVIRONMENT IS TO BE SAVED. (W71-07996).

00554. BIOLOGICAL TREATMENT OF BLEACH PLANT WASTES.

CHARLES, G.E.; DECKER, G.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42(10), 1725-1739, 1970.

CANADA'S FRASER RIVER IS A MAJOR SALMON PRODUCING WATERSHED. WHEN SEVERAL PULP AND PAPER MILLS WERE BUILT, EFFLUENT STANDARDS WERE IMMEDIATELY SET WHICH INCLUDED: (1) AN AERATED BASIN OF 5 DAY RETENTION TIME; (2) 65% BOD5 REMOVAL; (3) MAXIMUM EFFLUENT BOD5 OF 80 MGL. AND (4) EFFLUENT DILUTED TO 65% CONCENTRATION WITH RIVER WATER SHALL NOT CAUSE MORTALITY TO YEARLING SALMON IN A 96 HOUR PERIOD. A LOW-RATE ACTIVATED SLUDGE TREATMENT SYSTEM CONSISTING OF NEUTRALIZING, SEEDING, AND AERATING WAS CHOSEN FOR BLEACH PLANT WASTES, WITH THE COMBINED SYSTEM HAVING A DETENTION TIME OF 24 HOURS. A TWO YEAR STUDY INDICATED THAT BOTH BOD AND TOXICITY LEVELS WERE WITHIN THE STIPULATED LIMITS WITH THE EXCEPTION OF SEVERAL PERIODS OF UPSET OF THE SYSTEM. UNSCHEDULED SHUT DOWNS WERE FOUND TO DECREASE THE LOAD ON THE SYSTEM ENOUGH TO UPSET THE OPERATION AFTER LOADING RESUMED. THIS PROBLEM WAS SOLVED BY THE ADDITION OF AMMONIUM PHOSPHATE TO THE SYSTEM AT A REDUCED RATE. NUTRIENT ADDITIONS WERE ALSO FOUND TO BE NECESSARY, WITH THE RATIO OF BOD5 REMOVED TO NITROGEN TO PHOSPHORUS OF 100 TO 5 TO 1 FOUND TO ACHIEVE THE BEST RESULTS. A D. O. RESIDUAL OF 0.5 MG/L WAS MAINTAINED AT ALL TIMES TO FACILITATE BIOLOGICAL TREATMENT. THE TREATMENT COSTS FOR THE SYSTEM AVERAGED $1.40/TON OF PRODUCT, THE BULK OF WHICH GOES TOWARD NEUTRALIZATION AND NUTRIENT ADDITION. (W71-07999).

00555. A PRACTICAL APPROACH TO THE FILTRATION OF METAL HYDROXIDES.

CUTHBERTSON, R.S.; HETTWER, E.B.
PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 17TH, NIAGARA FALLS, ONTARIO, P 178-193, JUNE 7-10, 1970.

NORTHERN ELECTRIC CO. PRODUCES TELEPHONE SET PARTS PLATED WITH COPPER, NICKEL, CHROME, ZINC, TIN, GOLD, AND SILVER. PLATING WASTES INCLUDE ALL THESE METALS PLUS CYANIDE, CHROMIC ACID, AND HOT MINERAL ACIDS. STANDARD CHEMICAL PRECIPITATIONS ARE USED TO REMOVE THE HEAVY METAL AND THEIR SALTS, BUT HIGH SUSPENDED SOLIDS CONCENTRATIONS PREVENT DIRECT DISCHARGE OF THE EFFLUENT TO A RECEIVING WATER. A PRESSURE FILTRATION UNIT

DESIGNED FOR A LOADING OF .17 GPM/FT SQ. AND USING A 1200 GALLON PRE-COAT TANK, A 150 GPM, 50 PSI HEAD PRE-COAT PUMP AND A 300 GALLON BODY FEED TANK AND 350 FT SQ OF FILTER AREA WERE CONSTRUCTED. THE SYSTEM WAS A TOTAL FAILURE BOTH FROM OPERATIONAL AND FINANCIAL STANDPOINT. AFTER CONSULTING OTHER PRODUCERS ABOUT TREATMENT OF PLATING WASTES, AND ENGAGING A CONSULTANT, THE FOLLOWING MODIFICATIONS WERE DEVELOPED: (1) FILTER SEPTUMS OF DACRON WERE CHANGED TO STAINLESS STEEL MESH; (2) ASBESTOS FIBRES WERE USED AS PRE-COAT BECAUSE OF EASE OF MAINTENANCE; (3) FLOW WAS REGULATED FROM 4-50 GPM; (4) A STAND-BY SEDIMENTATION TANK WAS CONSTRUCTED TO ALLOW AS MUCH AS 60% OF FLOW TO SETTLE BY GRAVITY AND BY-PASS THE FILTER; (5) POLYELECTROLYTE FLOCCULANT AID WAS ADDED TO FACILITATE SETTLING. COSTS FOR THIS SYSTEM ARE ESTIMATED AT $77/WEEK, WHICH, BASED ON A 300,000 GALLON FLOW, IS $.23/1000 GALLON OF EFFLUENT WITH A DRY SLUDGE PRODUCTION OF 1 TON OF SOLIDS. FUTURE WORK IS TO BE DIRECTED TOWARD ENLARGING THE SETTLING TANK FOR INCREASED DETENTION TIME, AND INCREASED SLUDGE HOLDING FACILITIES ARE ALSO PLANNED. (W71-08012).

00556. CHRYSLER CANADA LTD. INDUSTRIAL WASTE TREATMENT PLANT, WINDSOR, ONTARIO.

OSMUN, D.O.

ONTARIO INDUSTRIAL WASTE CONFERENCE, 17TH, NIAGARA FALLS, ONTARIO, P 194-213, JUNE 7-10, 1970.

EXPANSION OF THE CHRYSLER CANADA LTD., WINDSOR, ONTARIO PLANT NECESSITATED THE DEVELOPMENT OF A WASTE WATER TREATMENT FACILITY. THE PRELIMINARY STUDIES ON THE PROBLEM WERE CONDUCTED BY A CONSULTING ENGINEERING FIRM. THE PLANT WAS DESIGNED AND BUILT AT A TOTAL COST OF $3,140,000, AND CLOSE SUPERVISION OF DETAIL WAS PROVIDED BY CHRYSLER CANADA LTD IN AN EFFORT TO KEEP COSTS DOWN WITHOUT SACRIFICING PLANT EFFICIENCY OR CAPACITY. A THREE STAGE SYSTEM WAS DEVELOPED TO TREATEFFLUENTS CONTAINING WELDING COOLANTS, ACID WASHWATER, PHOSPHATE DIP, CAUSTIC DIP, ANTI-FREEZE, GASOLINE, EMULSIFIED CLEANERS, PAINTS, FREE AND SOLUBLE OILS, AND HEAVY SUSPENDED SOLIDS. STAGE ONE CONSISTS OF 4 BATCH CLARIFIER TANKS UTILIZING SULFURIC ACID TO BREAK OUT THE OIL. THE RESULTANT SOLIDS ARE THEN SETTLED, FILTERED AND TRUCKED TO A MUNICIPAL LANDFILL. STAGE TWO INVOLVES REMOVAL OF SUSPENDED SOLIDS BY CHEMICAL REACTION AND AIR FLOTATION. THE FLOATED FLOC IS REMOVED BY SKIMMING, CONCENTRATED, AND INCINERATED. STAGE THREE IS A SOLIDS CONTACT CLARIFIER EMPLOYING ALUM AND COAGULATE AID TO FORM A SLUDGE, AND LIME OR CAUSTIC SODA TO CONTROL PH. PLANT CAPACITY IS RATED AT 2,200,000 GALLONS ON A 16 HOUR DAY WHICH CAN BE INCREASED TO 3,000,000 GALLONS BY RUNNING 24 HOURS/DAY. ALL SLUDGE WASTE MATERIALS WITH THE EXCEPTION OF GRIT AND HEAVY SOLIDS ARE INCINERATED. CHEMICAL COST AVERAGES 15 CENTS TO 30 CENTS/1000 GALLONS. SAMPLING ON INFLUENT AND EFFLUENT IS AUTOMATIC, AND ALL SAMPLES ARE ANALYZED FOR: (1) SS, (2) OILS, (3) PH, (4) SETTLING RATE, (5) ALKALINITY, (6) TEMPERATURE, (7) OTHER CHEMICALS IF SUSPECTED. WATER WHICH DOES NOT MEET EFFLUENT REQUIREMENTS IS STORED AND TREATED AGAIN. (W71-08013).

00557. OPERATIONAL GROWING PAINS OF AN INDUSTRIAL WASTE TREATMENT PLANT.

COX, H.G.

PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 17TH, NIAGARA FALLS, ONTARIO, P 214-222, JUNE 7-10, 1970.

THE RCA LTD. PLANT AT MIDLAND, ONTARIO, IS SITUATED IN A HIGHLY SCENIC RECREATIONAL AREA WHERE POLLUTION CONTROL OF BOTH AIR AND WATER IS ESSENTIAL. THE PLANT PRODUCES ONLY COLOR TELEVISION PICTURE TUBES. EFFLUENTS FROM THE PLANT CONTAIN MOSTLY ACID AND ALKALI WASH AND RINSE WATERS. THE SEWERS ARE BROKEN DOWN INTO CATEGORIES: (1) SANITARY SEWERS CONNECTED TO THE TOWN OF MIDLAND SEWERAGE SYSTEM, (2) CLEAR WATER DRAINS FOR ROOF DRAINS AND UNTREATED COOLING WATERS, (3) CAUSTIC DRAINS, AND (4) SARAN-LINED STEEL PIPE ACID DRAINS. THE TREATMENT SYSTEM CONSISTS OF HOLDING TANKS, CHROME REDUCTION TANKS, NEUTRALIZATION TANKS, THREE DIATOMACEOUS EARTH PRESSURE FILTERS, AND STORAGE LAGOONS. THE PROBLEMS INVOLVED WITH THE START UP, AND THE CONTINUED OPERATION OF THE PLANT ARE DISCUSSED ALONG WITH THE REMEDIAL ACTION TAKEN. PROBLEMS RANGED FROM THOSE ASSOCIATED WITH OVERFLOW CAUSED BY UNDERSIZED LINES TO THOSE STEMMING FROM LAUNDRY SHRINKING OF DACRON FILTER BAGS. 50 MILLION U. S. GALLONS WERE TREATED IN 1969 AT A TOTAL COST INCLUDING DEPRECIATION AND OVERHEAD OF ABOUT $1.40 PER THOUSAND GALLONS. OPERATIONAL IMPROVEMENTS AND INCREASED MAIN PLANT LOAD ARE EXPECTED TO REDUCE THE COST TO SOMEWHERE AROUND $1.00/1000 GALLONS IN THE NEAR FUTURE. (W71-08014).

00558. TECHNIQUES OF DEEP WELL DISPOSAL - A SAFE AND EFFICIENT METHOD OF POLLUTION CONTROL.

STEWART, R.S.

PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 15TH, P 37-43, JUNE 9-12, 1968.

THE BASIC REQUIREMENTS FOR A DEEP WELL DISPOSAL SYSTEM ARE: A SUBSURFACE HORIZON, PREFERABLY OF SANDSTONE FILLED WITH SALT WATER, AND LOCATED AT A SUFFICIENT DEPTH AND SUITABLE GEOLOGICAL SEQUENCE SO THERE MIGHT BE NO CONTAMINATION OF ANY WATER SOURCES. THE PRIMARY DISADVANTAGE OR DANGER OF THE DEEP WELL DISPOSAL IS THE POLLUTION OF GROUNDWATER WHICH COULD BE LIMITED THROUGH ORIGINAL PROGRAM DESIGN. THE TECHNIQUES OF DRILLING A DEEP WELL DISPOSAL SYSTEM AND EQUIPPING IT IN A SATISFACTORY MANNER ARE DERIVED FROM THE OIL AND GAS INDUSTRY BUT WITH THE PRIMARY CONCERN THAT THIS WELL SHOULD BE FREE OF ANY POSSIBLE DEFECTS THAT COULD ALLOW CONTAMINATION OF POTABLE WATER OR MINERAL SOURCES. THIS COULD BE ACHIEVED BY AN ELABORATE CONTROL OVER THE DRILLING, CASING AND CEMENTING PROGRAM. A SCHEMATIC DIAGRAM SHOWING ALL THESE FACTORS IS GIVEN. IN GENERAL THE COST OF THE DEEP WELL DISPOSAL IS ABOUT ONE THIRD OF ANY OTHER METHOD OF NEUTRALIZATION. (W71-08015).

COST ANALYSIS OF WATER POLLUTION CONTROL

00559. INCINERATION OF PROCESS INDUSTRY WASTES.

LOMBARD, W.K.
PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 15TH, P 43-60, JUNE 9-12, 1968.

COMBUSTION, OR INCINERATION, IS ONE OF THE EFFECTIVE METHODS OF DISPOSAL OF INDUSTRIAL WASTES. ANALYSIS OF THE WASTES INVOLVED COULD DETERMINE THE POSSIBILITY OF THIS METHOD. INCINERATION EQUIPMENT SHOULD HAVE AIR FOR OXYGEN AND TEMPERATURE, TURBULENCE AND TIME FOR GOOD COMBUSTION. THE TYPES OF WASTES THAT COULD BE HANDLED BY THIS METHOD ARE: (1) RICH LIQUIDS, (2) WEAK LIQUIDS, (3) HALOGENATED LIQUIDS, (4) FUMES AND HIGH HEATING, VOLUME BULK MATERIALS. THESE WASTES ALONG WITH THE SUITABLE INCINERATOR ARE DISCUSSED IN DETAIL INCLUDING COST. AN EXAMPLE OF THE COST RANGE FOR A RICH LIQUIDS INCINERATOR OF A 500 LB/HR BURNING CAPACITY IS $10-15,000 WHILE THE COST OF A 2000 LB/HR WEAK LIQUIDS INCINERATOR IS $35-40,000 AND WOULD REQUIRE 8 MILLION BTU/HR OF AUXILIARY FUEL. HEAT RECOVERY FROM THESE INCINERATORS IS RECOMMENDED ONLY IF THE SAVINGS OR BY PRODUCTS CREATED WILL PAY FOR THE ADDITIONAL INITIAL COST IN NO MORE THAN ONE YEAR. AN EXAMPLE CASE OF A CENTRAL DISPOSAL FACILITY WHICH IS BEING CONSTRUCTED ON THE ST. CLAIR RIVER IS REVIEWED. (W71-08016)

00560. SEWER FLOW MEASUREMENT IN A LARGE INDUSTRIAL PLANT.

LIVINGSTONE, D.D.
PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 15TH, P 146-156, JUNE 9-12, 1968.

FOR ACCURATE DESIGN OF NEW POLLUTION CONTROL FACILITIES, AND MORE ACCURATE MEASUREMENT OF THE ACTUAL PERFORMANCE OF THE TREATMENT FACILITIES, A SURVEY SCHEME WAS DEVELOPED IN 1967 TO MEASURE ALL IMPORTANT DISCHARGES AND IDENTIFY THE SOURCES OF THESE STREAMS. THE ALLOWABLE ERROR WAS 10%. DESCRIPTION OF THE PLANT AND THE TREATMENT FACILITIES WITH A PLAN LAYOUT IS GIVEN. A RECOMMENDED EIGHT POINT SURVEY PLAN IS OUTLINED. THE MEASUREMENT EQUIPMENT USED IN THIS SURVEY WAS THE PORTABLE TYPE, AT A COST LESS THAN $500. THE DOLL FLOW TUBE, THE CURRENT METER, THE PILOT TUBE, BUCKET AND STOP WATCH (BUCKET WAS USED FOR SETTLING BASIN) AND THE SALT DILUTION METHODS GAVE THE REQUIRED RESULTS WITHIN THE ALLOWABLE ERROR AND AT A LOW COST. (W71-08020).

00561. A PRELIMINARY 'LEAST COST' STUDY OF FUTURE GROUNDWATER DEVELOPMENT IN NORTHEASTERN ILLINOIS.

MOENCH, A.F.; VISOCKY, A.P.
STATE OF ILLINOIS DEPARTMENT OF REGISTRATION AND EDUCATION, SPRINGFIFELD, CIRCULAR 102, 1971. 19 P.

AN ESTIMATE WAS MADE OF THE AVERAGE COST OF PRODUCING GROUNDWATER IN NORTHEASTERN ILLINOIS AND TO TREAT IT TO MAKE IT COMPARABLE IN QUALITY WITH TREATED LAKE MICHIGAN WATER. A DIGITAL SIMULATION MODEL WAS USED. THE COST OF RAW AND TREATED GROUNDWATER PRODUCED IN QUANTITIES SUFFICIENT, IN MOST CASES, TO MEET THE PROJECTED DEMAND TO 2020 WAS ESTIMATED FOR EACH TOWNSHIP IN THE SIX-COUNTY AREA. THREE SOURCES OF GROUNDWATER WERE CONSIDERED: THE SHALLOW SAND AND GRAVEL AQUIFERS, THE SHALLOW DOLOMITE AQUIFERS, AND THE DEEP SANDSTONE AQUIFERS. UNIT COSTS OF WELLS, PUMPS, AND REHABILITATION WERE OBTAINED FOR EACH AQUIFER IN EACH TOWNSHIP. THESE INCLUDED BOTH AMORTIZED CAPITAL COSTS AND OPERATION-MAINTENANCE-REPAIR COSTS (IN 1970 DOLLARS). THE COSTS OF STORAGE AND DISTRIBUTION TO CONSUMERS WERE NOT CONSIDERED. RESULTS SHOWED TAHT RAW WATER VARIED IN COST FROM AS LITTLE AS 2 CENTS PER 1000 GALLONS TO AS MUCH AS 147 CENTS PER 1000 GALLONS DEPENDING UPON THE DEPTH TO THE DEEP SANDSTONE WATER. THE UNIT COST OF TREATED WATER VARIED FROM 22 TO 53 CENTS PER 1000 GALLONS, THE LOWER COSTS APPLYING TO THE LARGEST USERS BECAUSE OF THE ECONOMY OF SCALE IN TREATMENT. ALSO BECAUSE OF THIS ECONOMY OF SCALE, THE COST OF TREATED WATER TENDED TO DECREASE WITH TIME; THE COST OF RAW WATER INCREASED WITH TIME. FOURTEEN TOWNSHIPS WERE FOUND TO BE DEFICIENT IN GROUNDWATER IN 2020, BY A TOTAL OF 147 MILLION GALLONS PER DAY, AND WILL HAVE TO FIND ALTERNATIVE SOURCES. (W71-08123).

00562. COST OF DOMESTIC WELLS AND WATER TREATMENT IN ILLINOIS.

GIBBS, J.P.
ILLINOIS DEPARTMENT OF REGISTRATION AND EDUCATION, SPRINGFIELD, CIRCULAR 104, 1971. 23 P.

COST INFORMATION IS GIVEN FOR PRIVATE RESIDENTIAL GROUNDWATER SUPPLY SYSTEMS IN ILLINOIS. GRAPHS CAN BE USED TO MAKE REASONABLY ACCURATE COST PREDICTIONS FOR DIFFERENT TYPES AND DEPTHS OF WATER SUPPLY WELLS. A TYPICAL DOMESTIC WELL IN ILLINOIS MAY BE EXPECTED TO COST ABOUT $575. COST DATA FOR PUMPING SYSTEMS EQUIPPED WITH 10-GPM SUBMERSIBLE PUMPS SHOW THAT THE AVERAGE COST OF THESE SYSTEMS IS ABOUT $585. THE COSTS OF TREATING WATER FOR DOMESTIC USE ALSO ARE SUMMARIZED. TWO GRAPHS ILLUSTRATE THE MONTHLY COSTS OF SOFTENING AND REMOVING IRON AT VARYING MONTHLY CONSUMPTION RATES AND CONCENTRATIONS OF HARDNESS-FORMING MINERALS AND IRON. THE MONTHLY COST OF CONTINUOUS CHLORINATION IS CALCULATED. USE OF THE DATA PRESENTED MAKES IT POSSIBLE TO ESTIMATE THE MONTHLY COSTS OF RAW AND TREATED WATER FROM A DOMESTIC GROUNDWATER SUPPLY. TWO MAPS SHOW THE PROBABLE COSTS OF DOMESTIC RAW WATER SUPPLY SYSTEMS FROM SAND AND GRAVEL WELLS AND BEDROCK WELLS THROUGHOUT THE STATE. FOR A TYPICAL INSTALLATION AND DOMESTIC USE RATE IN ILLINOIS, THE MONTHLY COST OF RAW WATER IS ABOUT $11.00, SOFTENED WATER $15.40, SOFTENED TREATED FOR IRON $22.00, AND SOFTENED WATER TREATED FOR IRON AND CHLORINATED $25.00. SIMILAR CALCULATIONS FOR ANY TYPE AND DEPTH OF WELL, WATER QUALITY, AND TREATMENT CAN BE MADE FROM THE INFORMATION IN THIS REPORT. THIS MATERIAL SHOULD PROVIDE ADEQUATE INFORMATION FOR PLANNING PURPOSES AND DECISION MAKING IN DEVELOPING A DESIRED DOMESTIC SUPPLY. (W71-08129)

00563. COST OF MUNICIPAL SEWAGE TREATMENT PLANTS IN ILLINOIS.

BUTTS, T.A.; EVANS, R.L.
ILLINOIS DEPARTMENT OF REGISTRATION AND EDUCATION, SPRINGFIELD, CIRCULAR 99, 1970. 37 P.

CONSTRUCTION COSTS ARE SUMMARIZED FOR 291 MUNICIPAL SEWAGE TREATMENT PLANTS BUILT IN ILLINOIS BETWEEN 1957 AND 1968. MOST OF THE PLANTS WERE

BUILT UNDER THE FEDERAL CONSTRUCTION GRANTS PROGRAM (PUBLIC LAW 660). LEAST SQUARES REGRESSION ANALYSIS WAS USED TO RELATE DESIGN POPULATION EQUIVALENTS TO EITHER UNIT COSTS IN TERMS OF DOLLARS PER DESIGN EQUIVALENT OR TOTAL COSTS IN TERMS OF DOLLARS. THE DATA WERE CATEGORIZED INTO EIGHT CLASSIFICATIONS FOR NEW PLANTS AND TWO FOR PLANT ADDITIONS. ALSO, REGRESSION EQUATIONS WERE DEVELOPED FOR ESTIMATING LAGOON LAND COSTS, PLANT OPERATING COSTS, AND FWPCA CONSTRUCTION COST INDEXES. USE OF INFORMATION PRESENTED IN THIS CIRCULAR SHOULD PROVIDE REASONABLE ESTIMATES OF THE INITIAL INVESTMENTS INVOLVED IN CONSTRUCTING AND EQUIPPING SEWAGE TREATMENT PLANTS IN THE STATE. SAMPLE COST ESTIMATES ARE GIVEN FOR EACH TYPE OF PLANT ANALYZED. THESE ESTIMATES ARE NOT ALTERNATIVES TO DETAILED ENGINEERING COST ANALYSES, RATHER THEY ARE INTENDED TO PERMIT REASONABLE ESTIMATES WITH A MINIMUM OF EFFORT FOR COMPARATIVE PURPOSES. COST FIGURES AND DESIGN CRITERIA WERE SUPPLIED BY CONSULTING ENGINEERS, THE ILLINOIS SANITARY WATER BOARD, AND THE GREAT LAKES REGIONAL OFFICE OF THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. APPROXIMATELY 325 PROJECTS WERE REVIEWED, AND THE DATA FOR 291 WERE CONSIDERED ADEQUATE FOR STATISTICAL ANALYSIS. (W71-08130).

00564. COST OF DEHYDRATING POULTRY MANURE.

POULTRY DIGEST, P 143, MAR 1971.

CONVENTIONAL DEHYDRATING EQUIPMENT IS AVAILABLE FOR DRYING POULTRY MANURE. HOWEVER, THE COST OF THE PROCESSED MANURE IS LIKELY TO EXCEED $20 PER TON. A TWO-STAGE DRYING PROCESS HAS BEEN DEVELOPED THAT BRINGS THE COST DOWN TO $7.60 PER TON FOR A PRODUCT WITH 10% MOISTURE. THE FINAL PRODUCT IS A FINE POWDER, FREE OF OFFENSIVE ODORS, HAS SHELF LIFE AND IT HAS THE QUALITIES REQUIRED FOR SALE AS AN ORGANIC FERTILIZER. IT CONTAINS 4 TO 5% NITROGEN, 3% PHOSPHORIC ACID, AND 2.5% POTASH. (W71-08211).

00565. DISTILLATION OF WASTE WATERS: A WATER RESOURCE FOR ARID REGIONS.

CYWIN, A.; REY, G.; DEA, S.; BERNARD, H.
WATER QUALITY MANAGEMENT PROBLEMS IN ARID REGIONS, WATER POLLUTION CONTROL RESEARCH SERIES, 13030 DYY, 6/69, OCT 1970, P 85-94.

THE AUTHORS PROPOSE DISTILLATION OF MUNICIPAL WASTEWATER FOR THE PRODUCTION OF LOW MINERAL CONTENT WATER FOR INDUSTRIAL PURPOSES, PARTICULARLY FOR THOSE INDUSTRIES WHICH REQUIRE SUCH WATER IN LARGE QUANTITIES. DISTILLATION HAS PREVIOUSLY BEEN LIMITED IN ARID REGIONS TO APPLICATIONS USING SALINE WATERS AS A FEEDWATER SUPPLY. THE USE OF WASTE WATER MAY VERY POSSIBLY RESUL . LESS COSTLY DISTILLED WATER. A PART OF THE WASTE WATER RENOVATION COSTS CAN BE ATTRIBUTED TO POLLUTION CONTROL. DILUTION OF TERTIARY-TREATED EFFLUENTS WITH A LOWER MINERAL CONTENT MUNICIPAL WATER CAN ALSO PRODUCE A PRODUCT WATER OF ACCEPTABLE MINERAL CONTENT. THE LOWER CONCENTRATIONS OF SULFATE AND TOTAL DISSOLVED SOLIDS IN WASTE WATER EFFLUENTS ARE ALSO ADVANTAGEOUS. TOTAL TREATMENT COSTS FOR THE PROCESSES INVOLVED ARE GIVEN. (W71-08227).

00566. STORM SEWER SYSTEMS.

POERTNER, H.G.
PUBLIC FACILITY NEEDS, WASHINGTON, DC, 1966, P 152-174.

A DESCRIPTION IS PRESENTED OF THE NATURE AND COMPOSITION OF STORM SEWER SYSTEMS, THEIR FUNCTIONS, AND THE FUNDAMENTAL PRINCIPLES INVOLVED. THE SERVICES RENDERED BY SUCH SYSTEMS, PARTICULARLY AVOIDANCE OF ECONOMIC LOSS FROM FLOODING AND INADEQUATE RUNOFF, ARE CITED, ALONG WITH DANGERS AND DAMAGES THAT CAN EXIST. BOTH QUANTITATIVE AND QUALITATIVE STANDARDS OF PERFORMANCE AND DESIGN ARE DISCUSSED. A BRIEF HISTORY OF STORM SEWERS IS INCORPORATED INTO A DISCUSSION OF EXISTING CAPITAL PLANT OF THE SEWERS, AND CAPITAL INVESTMENT IN URBAN DRAINAGE IMPROVEMENTS IS PRESENTED BY BOTH REGIONAL AND STATE BREAKDOWNS, INDICATING BOTH SEWER SYSTEM AGE AND OWNERSHIPS. COSTS, CHARGES, AND BENEFITS OF THE SEWER SYSTEM PRESENT THE ECONOMIC BASIS FOR THE SYSTEMS, AND TRENDS OF CAPITAL OUTLAY ARE PRESENTED ACCORDING TO EXPENDITURES AND SOURCES OF FINANCING. ESTIMATED CAPITAL REQUIREMENTS PRESENT A PROJECTION FOR NEEDS AND PROSPECTIVE CAPITAL OUTLAYS IN THE STORM SEWER SYSTEMS AND INDICATE THE MAJOR SOURCES TO BE TAPPED FOR SUCH FINANCING. (W71-08285).

00567. SANITARY SEWER COLLECTION SYSTEMS.

ROWAN, P.
PUBLIC FACILITY NEEDS, WASHINGTON, DC, 1966, P 137-151.

A COMPREHENSIVE STUDY IS PRESENTED OF SANITARY SEWER COLLECTION SYSTEMS AS THE MEANS OF REMOVING WASTES. A BRIEF HISTORY OF THE DEVELOPMENT OF SUCH SYSTEMS IS PRESENTED, WHICH INCORPORATES A DISCUSSION OF POLLUTION IN ADDITION TO PRESENTING VARIOUS MEANS OF WASTE REMOVAL. THE PHYSICAL CHARACTERISTICS AND THE STANDARDS OF PERFORMANCE OF THE SEWER SYSTEMS ARE PRECISELY DESCRIBED, AND THE EXISTING CAPITAL PLANT FOR SUCH FACILITIES IS DISCUSSED. PARTICULAR ATTENTION IS GIVEN TO GROWTH, DISTRIBUTION, AND OWNERSHIP PATTERNS. CONSTRUCTION, OPERATION AND MAINTENANCE COSTS ARE JUXTAPOSED WITH USER CHARGES, AND TRENDS IN CAPITAL OUTLAY ARE SUBDIVIDED INTO ANNUAL OUTLAYS AND SOURCES OF FINANCING. NEEDS AND PROSPECTIVE CAPITAL OUTLAYS FOR THE FUTURE ARE PRESENTED, AND ESTIMATED CAPITAL REQUIREMENTS ARE SUGGESTED, ALONG WITH POTENTIAL MEANS OF FINANCING. THE ROLE OF FEDERAL ASSISTANCE IN THE FUTURE ECONOMIC DEVELOPMENT OF THE SEWER COLLECTION SYSTEMS IS ALSO DEALT WITH IN SOME DETAIL. (W71-08286).

00568. COOLING TOWERS FOR LARGE STEAM-ELECTRIC GENERATING UNITS.

WOODSON, R.D.
ELECTRIC POWER AND THERMAL DISCHARGES; THERMAL CONSIDERATIONS IN THE PRODUCTION OF ELECTRIC POWER, GORDON AND BREACH, NEW YORK, P 351-380, 1971.

ALL FEASIBLE TYPES OF COOLING TOWERS HAVE BEEN CONSIDERED AND THE COST OF EACH TYPE IS ILLUSTRATED FOR A TYPICAL 800 MEGAWATT UNIT. MECHANICAL DRAFT WET TOWERS ARE THE MOST ECONOMICAL TYPE OF COOLING TOWERS FOR NEARLY ALL APPLICATIONS. ALTHOUGH APPARENTLY FEASIBLE, DRY TYPE COOLING TOWERS ARE NOT ECONOMICALLY COMPETI-

TIVE DUE TO HIGH INVESTMENT COSTS AND LOWER STEAM CYCLE EFFICIENCY DUE TO HIGH CONDENSER PRESSURES. SOME MAY BE INSTALLED UNDER SPECIAL CIRCUMSTANCES. SOPHISTICATED DESIGN AND OPTIMIZATION OF BOTH COOLING TOWER AND COOLING SYSTEMS ARE BEING DONE AND WILL CONTINUE TO DEVELOP, INCLUDING DIRECT DIGITAL CONTROL MANAGEMENT OF COOLING TOWER OPERATION. (W71-08314).

00569. COMBINED TREATMENT OF DOMESTIC AND INDUSTRIAL WASTES BY ACTIVATED SLUDGE.

GRAHAM, J.L.; FILBERT, J.W.
PROCEEDINGS, FIRST NATIONAL SYMPOSIUM ON FOOD PROCESSING WASTES, APRIL 6, 7, 8, 1970, PORTLAND, OREGON, WATER POLLUTION CONTROL RESEARCH SERIES NO 12060--04/70, P 91-117.

CONVENTIONAL APPROACHES TO TREATMENT PLANT DESIGN HAVE BEEN FOUND INADEQUATE TO PROVIDE THE NECESSARY DEGREE OF TREATMENT, THE OPERATIONAL FLEXIBILITY, AND THE SYSTEM STABILITY REQUIRED. THE NEED FOR A NEW SYSTEM LED TO THE INVESTIGATION OF A COMPLETELY AEROBIC SCHEME OF TREATMENT. SUCH A PLANT WAS CONSTRUCTED TO HANDLE WIDELY VARIABLE COMBINED MUNICIPAL AND INDUSTRIAL WASTES, MAINLY CANNERY WASTES. AVERAGE FLOW THROUGH THE PLANT WAS 2 MGD, WITH A BOD5 LOADING OF 7,080 LB/DAY DURING THE CANNING SEASON, AND 2,080 LB/DAY DURING THE OFF-SEASON. VARIOUS ML/L LEVELS WERE EXPERIMENTED WITH, RANGING FROM 700 MG/L TO 3000 MG/L IN THE AERATION TANK. ALKALINITY IN THE INFLUENT FLOW WAS FOUND TO BE SUFFICIENT TO BUFFER THE SYSTEM. 95% OF THE TIME, EFFLUENT BOD5 WAS 7 MG/L OR LESS. TOTAL CONSTRUCTION COST OF THE PLANT, CONSISTING OF AERATION BASINS, FINAL CLARIFIER, AEROBIC DIGESTION, CHLORINATION, AND SLUDGE LAGOONS, WAS $506,300, AS COMPARED TO $950,000 FOR A CONVENTIONAL PLANT, OR A SAVINGS OF 47%. OPERATION AND MAINTENANCE COSTS WERE FOUND TO BE $20/1,000,000 GAL. TREATED, OR A 70% SAVINGS OVER CONVENTIONAL TREATMENT. THE FOLLOWING ADDITIONAL CONCLUSIONS WERE DRAWN FROM THE INITIAL DATA: (1) ENOUGH PROCESS FLEXIBILITY IS PROVIDED TO HANDLE SHOCK ORGANIC LOADS AND ABRUPT LOADING CHANGES; (2) NO SPECIAL OPERATING PROBLEMS WERE CAUSED IN THIS INSTANCE BY ELIMINATION OF PRIMARY CLARIFICATION AND GRIT REMOVAL; (3) DESPITE LARGE FLOW AND ORGANIC LOADING FLUCTUATIONS, EFFLUENT QUALITY REMAINED CONSISTENTLY GOOD, (4) AEROBIC DIGESTION PROVIDED ADEQUATE STABILIZATION FOR THIS COMBINATION OF SLUDGES AT A SUBSTANTIAL REDUCTION IN COST OVER CONVENTIONAL TREATMENT. (W71-08404).

00570. AEROBIC TREATMENT OF LIQUID FRUIT PROCESSING WASTE.

ESVELT, L.A.
PROCEEDINGS, FIRST NATIONAL SYMPOSIUM ON FOOD PROCESSING WASTES, APR 6, 7, 8, 1970, PORTLAND, OREGON, WATER POLLUTION CONTROL RESEARCH SERIES, NO 12060--04/70, P 119-143.

THREE DIFFERENT COMBINATIONS OF TWO BASINS, AERATED LAGOONING, ACTIVATED SLUDGE, AND ACTIVATED SLUDGE WITH SLUDGE REAERATION, WERE STUDIED TO DETERMINE THEIR APPLICABILITY TO THIS TYPE OF WASTE. EQUATIONS FOR BIOLOGICAL GROWTH, AERATION REQUIREMENTS, AND SLUDGE PRODUCTION WERE DERIVED FROM REACTOR KINETICS AND APPLIED TO THIS PROBLEM. FROM THE RESULTS OF DATA TAKEN OVER TWO PROCESSING SEASONS, THE FOLLOWING CONCLUSIONS WERE DRAWN: (1) BOTH ACTIVATED SLUDGE AND CONTACT STABILIZATION, WHEN LOADED AT F/M0. 4 ON A COD BASIS, WILL PROVIDE GREATER THAN 90% REMOVAL OF ORGANIC LOAD AND SS, WITH ACTIVATED SLUDGE REQUIRING FEWER FACILITIES AT LESSER COST, (2) AERATED LAGOONING PROVIDED 70% REMOVAL OF BOD, BUT ALLOWED CONSIDERABLE SUSPENDED SOLIDS LOSS WHICH CONTRIBUTED MOST BOD AND COD LOSS. HOWEVER, COST FOR SUCH A SYSTEM WAS CONSIDERABLY SMALLER THAN FOR EITHER OF THE OTHER TWO SYSTEMS. ACTUAL COSTS ARE $. 041/NO. BOD FOR AERATED LAGOONS, $. 061/NO. BOD FOR ACTIVATED SLUDGE AND $. 067/NO. BOD FOR CONTACT STABILIZATION. SURFACE AERATION, AND PVC LINING WERE BOTH FOUND TO BE SUITABLE FOR USE IN ALL THREE TYPES OF SYSTEMS. (W71-08405).

00571. WARM WATER UTILIZATION.

BOERSMA, L.
OREGON STATE UNIVERSITY, 1970. 49 P.

UTILIZATION OF THERMAL WATER RESULTING FROM POWER GENERATING PLANTS AS A SUPPLY OF ENERGY IS PROPOSED. THE POTENTIAL USES INCLUDE HEATING HOMES, GREENHOUSES, ANIMAL ENCLOSURES, SOILS, FERMENTED ORGANIC WASTES, AND CULTURES OF WATER INHABITING ORGANISMS. TO AVOID A LOSS OF THE VALUABLE RESOURCE, THE WATER MAY BE RECYCLED IN A CLOSED SYSTEM, ROUTED THROUGH EITHER A SOIL WARMING LOOP, OR EVAPORATIVE COOLING COILS. DETAILED INFORMATION IS INCLUDED ON THE RELATION OF HEAT AND SOIL TEMPERATURE, EXTENSIVE AND INTENSIVE COOLING SYSTEMS, PRODUCTION OF FARM CROPS, FISH AND ALGAL CULTURES, AND COST ANALYSIS. (W71-08671).

00572. DISPOSAL OF WASTES FROM WATER TREATMENT PLANTS--PART 2.

FABER, H.A.; KLOMP, K.C.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 61(11), 619-638, 1969.

CURRENT INFORMATION ON AND IMPROVED TECHNIQUES TO SOLVE THE PROBLEMS OF WATER TREATMENT PLANT WASTE DISPOSAL AND REGULATORY ASPECTS ARE GIVEN. SINCE ALUM IS A PRIME COAGULANT IN U S WATER PLANTS, DISPOSAL OF SLUDGE IS OF PRIMARY CONSIDERATION. DISCHARGE OF WATER TREATMENT PLANT WASTES DIRECTLY TO SURFACE WATERS IS IMPRACTICAL. AMONG VARIOUS METHODS OF WATER TREATMENT WASTE DISPOSAL DISCUSSED ARE LAGOONS, DISCHARGE TO SANITARY SEWERS, A FREEZING PROCESS (OPERATED IN THE UNITED KINGDO7), THE ADVANTAGES OF THE CENTRIFUGE METHOD, VACUUM FILTRATION, SAND DRYING BEDS, TREATMENT BY FILTER PRESSING, LARGING TO SEAS, PIPELINE TRANSPORT, AND COST OF ALUM RECOVERY. DISPOSAL OF FILTER WASHWATER, DISPOSAL OF SLUDGE FROM SOFTENING PLANTS, INCLUDING LAGOON TREATMENT, SEWER DISCHARGE, AND LIME RECLAMATION, TOGETHER WITH DISPOSAL OF BRINES ARE ALSO DELIBERATED. TOGETHER WITH THE STATUS OF PLANT OPERATION AND REGULATORY ASPECTS. (W71-08672).

REFERENCE LIST

00573. WASTE WATER CONTROL FACILITIES IN A PETROCHEMICAL PLANT.

RUCKER, J.E.; OEBEN, R.W.
CHEMICAL ENGINEERING PROGRESS, 66(11), 63-66, 1970.

THE UNION CARBIDE CORPORATION'S PETROCHEMICAL PLANT ADDITION AT PONCE, PUERTO RICO, IS PLANNED TO INCLUDE INSTALLATION OF A PRIMARY AND SECONDARY BIOLOGICAL TREATMENT PLANT FOR WASTE WATER FROM BOTH EXISTING AND NEW FACILITIES. NEW FACILITIES CONTAIN EQUIPMENT FOR RECYCLE AND PRODUCT RECOVERY. ENGINEERING EFFORTS TO FURTHER MINIMIZE WASTE EFFLUENTS CONTINUE THROUGH ALL PHASES OF DESIGN FOR EACH PRODUCTION UNIT AND OPERATION OF THE NEW UNITS. AQUEOUS POLLUTION CONTROL REPRESENTS A TOTAL IVNESTMENT OF $12.8 MILLION. OPERATING POLLUTION CONTROL PERSONNEL, TRAINING, AND DESIGN CRITERIA ARE TABULATED. METHODS USED FOR DETERMINING WASTE LOADS AND PROCESS DESIGN OF THE TERMINAL FACILITIES, INCLUDING INSTRUMENTATION AND CONTROL PROCEDURES, ARE DESCRIBED. DETERMINATION OF TOTAL WASTE WATER LOAD WAS BASED ON FLOW MEASUREMENT AND LABORATORY ANALYSIS OF WASTE STREAMS FROM THE EXISTING PLANT PLUS ESTIMATES OF AQUEOUS WASTE LOADS FROM NEW UNITS. WASTE WATER LOAD REMOVAL DESIGN WAS PLANNED TO AVOID TAKING WASTE STREAMS INTO THE TERMINAL TREATMENT PLANT WITHOUT FIRST INVESTIGATING KNOWN ALTERNATIVE DISPOSAL METHODS. THE SEWER SYSTEM IS DESIGNED TO SEGREGATE STORM OR FIRE WATER FROM PROCESS WASTE WATER STREAMS. MONITORING IS PROVIDED AT THE TREATMENT FACILITIES BY AN OPERATOR ON DUTY AROUND-THE-CLOCK. (W71-08676).

00574. ECONOMICS OF WATER QUALITY CONTROL MEASURES.

MICHALSON, E.L.
SPEECH AT ANNUAL MEETING OF SOIL CONSERVATION SOCIETY OF AMERAICA, BOISE, IDAHO, NOV 21-22, 1969. 12 P.

WHEN THE WASTE LOAD OF A STREAM IS TOO GREAT FOR THE STREAM TO ASSIMILATE, THERE ARE FOUR ALTERNATIVE METHODS AVAILABLE TO CONTROL WATER POLLUTION: (A) LOW FLOW AUGMENTATION, (B) PREVENTION, (C) TREATMENT, (D) RECYCLING OF EFFLUENTS. IN AN ECONOMIC SENSE THERE ARE TWO CHARACTERISTAICS OF WATER QUALITY THAT CREATE PROBLEMS: (1) VARIABILITY OF THE WATER SUPPLIES, (2) DIFFERENTIATION OF DEMAND FOR WATER OF VARIOUS QUALITIES ACCORDING TO USES. ANOTHER PROBLEM IS THAT BENEFITS ARE DIFFICULT TO IDENTIFY AND ALMOST IMPOSSIBLE TO QUANTIFY. FOR THESE REASONS THE MAJOR ECONOMIC INTERESTS REVOLVE AROUND THE COSTS OF CONTROL MEASURES. COSTS TO SOCIETY AND THE INDUSTRIAL POLLUTER NEED TO BE DETERMINED. SOME FORM OF GOVERNMENTAL COORDINATION ON WATER QUALITY AT THE FEDERAL LEVEL IS NECESSARY TO INSURE STANDARDS. WHEN THE PROBLEM OF WATER QUALITY CONTROL IS ADEQUATELY DEFINED, THEN ENGINEERS, ECONOMISTS AND OTHER RESEARCH WORKERS CAN FORMULATE OPTIMAL PLANS. (W71-08807)

00575. WATER RECLAMATION AND ALGAE HARVESTING.

MCGARRY, M.G.; TONGKASAME, C.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 43(5), 824-835, 1971.

APPLICATION OF HIGH RATE OXIDATION PONDS EQUIPPED WITH ALGAE HARVESTING MAY HELP TO AUGMENT THE DWINDLING WATER SUPPLIES OF LARGE METROPOLITAN AREAS BY RECLAIMING WASTE WATER FOR VARIED USES, WHILE AT THE SAME TIME PRODUCING A USABLE ALGAL FEED SUPPLEMENT. CONDITIONS FOR OPTIMAL OPERATION INCLUDE: (1) 200 LB BOD/ACRE/DAY; (2) 17.7 IN. DEPTH; AND (3) 1 DAY DETENTION TIME. PONDS OPERATED IN THIS MANNER PROVIDE AN AVERAGE EFFLUENT BOD (AFTER ALGAE REMOVAL) OF LESS THAN 10 MG/L, AND ONE ACRE OF POND CAN PRODUCE 100,000 LB PER YEAR OF ALGAE CONTAINING 60% PROTEIN. CHEMICAL COAGULATION AND PRECIPITATION CHEMICALS STUDIED INCLUDED LIME, ALUM, AND 50 DIFFERENT POLYELECTROLYTES. POLYCATIONS WERE FOUND TO BE MOST ECONOMIC, BUT USAGE OF POLYELECTROLYTES AS AIDS CONTRIBUTED A GREATER CHEMICAL COST THAN USAGE OF ALUM ALONE AT PH 6.5. THE DOWNFLOW SOLIDS CONTACT SYSTEM WAS EXAMINED FOR REMOVAL OF THE ALGAE, EITHER BY THE SPLIT FLOW, DISSOLVED AIR, OR SUPERSATURATED OXYGEN PRINCIPLES. THE ALGAL PASTE WAS SUN DRIED ON UNDRAINED FLAT PLATES, TO LESS THAN 10% MOISTURE. AT SOLAR ENERGY LEVELS OF 480 G CAL/SQ CM/DAY, 2800 LBS/DAY OF DRIED ALGAE COULD BE PROCESSED ON ONE ACRE. THE RESULTS OF THE INVESTIGATIONS WERE INCORPORATED INTO AN URBAN MODEL WHICH INCLUDES RECYCLING OF CLARIFIED POND EFFLUENT FOR HOUSEHOLD CLEANING PURPOSES. (W71-08951).

00576. NUTRIENTS AND NUTRIENT BUDGET IN THE BAY OF QUINTE, LAKE ONTARIO.

JOHNSON, M.G.; OWEN, G.E.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 43(5), 836-853, 1971.

ALGAE BLOOMS IN THE BAY OF QUINTE, LAKE ONTARIO, HAVE BEEN INCREASING IN SEVERITY AND LENGTH OVER THE PAST SEVERAL YEARS. EXAMINATION OF AQUATIC LIFE IN THE BAY REVEALED AN OVERWHELMING PREDOMINANCE OF ORGANISMS WHICH READILY FUNCTION IN ORGANICALLY RICH WATERS. INPUT TO THE BAY WAS MONITORED IN 1968. DURING THAT TIME, THE BAY RECEIVED 9.7 MILLION LBS OF NITROGEN AND 731,000 LBS OF PHOSPHATES FROM ALL SOURCES. APPROXIMATELY 90% OF THE ENTERING NITROGEN ENTERED VIA THE RIVERS WHICH EMPTY INTO THE BAY, AND THESE SAME RIVERS ACCOUNTED FOR 60% OF THE PHOSPHORUS INPUT. THE REMAINING 10% OF THE NITROGEN AND 40% OF THE PHOSPHORUS WERE CONTRIBUTED FROM MUNICIPAL-INDUSTRIAL SOURCES. HOWEVER, MUNICIPAL-INDUSTRIAL FLOWS ARE HIGH STRENGTH LOW VOLUME EFFLUENTS WHICH DISPLACE ONLY A SMALL VOLUME OF WATER FROM THE LAKE. ON THE OTHER HAND, RIVER FLOWS ARE EXTREMELY LOW STRENGTH HIGH VOLUME ADDITIONS TO THE BAY WHICH DISPLACE LARGE VOLUMES OF WATER. THEREFORE, IT WAS ESSENTIAL TO CONSIDER THE NET ADDITIONS OF P AND N RATHER THAN THE TOTAL ADDITIONS. THE NET ADDITION BEING THE AMOUNT OF NUTRIENT CONTAINED IN AN INPUT WHICH IS IN EXCESS OF THE AMOUNT OF NUTRIENTS CONTAINED IN THE VOLUME OF WATER DISPLACED AT THE OUTLET. ON THIS BASIS, 50% OF THE NET NITROGEN AND 85% OF THE NET PHOSPHORUS WERE CONTRIBUTED BY MUNICIPAL-INDUSTRIAL SOURCES. PHOSPHORUS REMOVAL FROM HIGH CONCENTRATION, LOW VOLUME INPUTS, AT A COST OF $200,000 PER YEAR WAS RECOMMENDED. (W71-08953)

00577. SOME PROBLEMS OF INDUSTRIAL WASTE DISPOSAL FROM A FERTILIZER PLANT.

PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 16TH, JUNE 1969, NIAGARA FALLS, ONTARIO, P 6-17.

THE TWO MAJOR POLLUTANTS IN EFFLUENTS FROM PHOSPHATE-CONTAINING FERTILIZER PLANTS ARE FLUORIDES AND GYPSUM. THE FLUORIDES ARE PRESENT AS 3 TO 4% BY WEIGHT OF THE PHOSPHATE ROCKS WHICH ARE USED TO PRODUCE PHOSPHATES. THE GYPSUM IS PRODUCED IN ACID SPLITTING OF THE PHOSPHATE FROM THE PHOSPHATE ROCK AND IS COLLECTED AS FILTER CAKE. GYPSUM IS FORMED AT A RATE OF 1.5 TO 1.6 TONS PER TON OF ROCK DIGESTED, OR 4.6 TO 5.2 TONS PER TON OF P SUB 2 O SUB 5 PRODUCED. TOTAL EFFLUENT FLOW AVERAGES 3500 IGPM, AND CONTAINS 27 TPD P SUB 2 O SUB 5, 68.7 TPD FLUORIDES, AND 2400 TPD GYPSUM. THIS EFFLUENT IS TREATED WITH LIME TO NEUTRALIZE THE P SUB 2 O SUB 5 AND FLURORIDES, SETTLED TO REMOVE THE PRECIPITATED PHOSPHATES AND FLUORIDES ALONG WITH THE BY-PRODUCT GYPSUM, AND DISCHARGED INTO THE GRAND RIVER AFTER CLARIFICATION. RECURRING PROBLEMS WITH OPERATION AND MAINTENANCE LED TO THE CONSTRUCTION OF A $270,000 ADDITION TO RECYCLE THE PLANT WATER. SIGNIFICANT OPERATION AND MAINTENANCE SAVINGS ARE BEING REALIZED, AND EFFLUENT FLOW HAS BEEN REDUCED FROM 3000 TO 4000 IGPM TO APPROXIMATELY 200 IGPM. (W71-08961).

00578. TREATMENT OF BRASS MILL EFFLUENTS AT ANACONDA TORONTO PLANT.

MCGRATH, J.J.

PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 16TH, JUNE 1969, NIAGARA FALLS ONTARIO, P 82-89.

A WASTE WATER TREATMENT PLANT, CONSISTING OF A COLLECTION SUMP, AN EQUALIZATION BASIN, IRON CONTACT LAUNDERS, COPPER SETTLING PITS, A CLARIFIER, A THICKENER TANK, AND A CONTROL BUILDING, WAS CONSTRUCTED AT A COST OF $750,000 TO TREAT SPENT ACIDS FROM A BRASS MILL. DUMPING VOLUME OF SPENT ACID SOLUTIONS AVERAGES 3500 CU FT ANNUALLY, WHILE 1300 CU FT OF DICHROMATE IS DUMPED PER WEEK. COPPER RECOVERY IS PRACTICED IN THE IRON LAUNDERS AND THE COPPER SETTLING TANKS. APPROXIMATELY 5 TONS OF SCRAP IRON TUBE ARE USED PER MONTH TO FORM 5 TONS OF COPPER CEMENTATE FROM WHICH COPPER METAL IS RECOVERED. SULFUR DIOXIDE IS AVAILABLE TO ASSIST IN THE REDUCTION IN THE IRON LAUNDERS, BUT BECAUSE OF THE USE OF SHORTER LENGTHS OF IRON TUBE, AND GREATER TURBULENCE, THE SULFUR DIOXIDE IS ONLY A SUPPLEMENTARY PROTECTION. 22 TONS OF HYDRATED LIME ARE USED EACH MONTH BOTH FOR PH CONTROL AND COAGULANT AID. 5 LBS 10 OZ. OF COAGULANT AID X 1633 ARE ALSO USED DAILY TO REDUCE THE PINPOINT FLOC ESCAPING IN THE EFFLUENT. TREATED EFFLUENT IS RE-USED AS COOLING WATER IN THE PLANT. EFFORTS ARE CONTINUING IN THE HOPE OF DISCOVERING NEW AND BETTER CHEMICALS FOR COAGULATION AND NEUTRALIZATION DEVELOPING IMPROVED RECOVERY TECHNIQUES, AND FINDING A MARKET FOR 28 TONS PER MONTH OF FILTER CAKE SLUDGE. (W71-08963).

00579. TREATABILITY STUDIES FOR INDUSTRIAL WASTES.

SLATER, R.W.; GUILLAME, F.

PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 16TH, JUNE 1969, NIAGARA FALLS, ONTARIO, P 124-140.

MANY REFERENCES CONTAIN DESIGN CRITERIA WHICH ARE GEARED TO THE AVERAGE INDUSTRIAL WASTE OF A PAPER MILL, OR A CHEMICAL PLANT, ETC. HOWEVER, NOT ONLY DO THESE CRITERIA LACK VALIDITY, BUT THE ANALYTICAL TESTS UPON WHICH THEY WERE BASED ARE ALSO INVALID. SUSPENDED SOLIDS AND BOD5 ARE BOTH OUTDATED PARAMETERS WHICH MUST BE REPLACED BY PARTICLE SIZE CHARACTERIZATION AND CARBON BALANCES RESPECTIVELY, BEFORE ANY PROGRESS CAN BE MADE IN ACHIEVING TRUE OPTIMAL DESIGNS. THREE CASE HISTORIES ARE PRESENTED, INCLUDING GRAPHS OF BOTH THE VALUES EXPECTED BY CONVENTIONAL DESIGN, AND THE VALUES OBTAINED BY USING EQUIPMENT WHICH SIMULATES THE ACTUAL COMPONENTS. IN ADDITION, THE VARIABILITY OF INDUSTRIAL PROCESSES NECESSARILY LEADS TO A VARIABILITY OF THE WASTES PRODUCED. CHANGES IN PRODUCTION TECHNOLOGY MAY CAUSE THE TYPE OF WASTE DISCHARGED TO LITERALLY CHANGE OVERNIGHT. TREATABILITY STUDIES WILL SAFELY PREDICT THE EFFECT OF SUCH CHANGES BEFORE THEY ARE ALLOWED TO UPSET THE PLANT AND JEOPARDIZE THE RECEIVING WATERS. IN THIS MANNER, THE COST EFFECTIVENESS OF DIFFERENT UNIT OPERATIONS CAN ALSO BE EVALUATED SO THAT MORE RATIONAL DECISIONS AND DESIGNS WILL RESULT IN CLEANER WATER AT LESS COST TO BOTH THE POPULACE AND THE INDUSTRY. (W71-08967).

00580. PRE-TREATMENT OF WASTES AT BARRIE TANNING LIMITED, BARRIE, ONTARIO.

YATABE, M.

PROCEEDINGS, ONTARIO INDUSTRIAL WASTE CONFERENCE, 16TH, JUNE 1969, NIAGARA FALLS, ONTARIO, P 176-187.

THE TREATMENT PLANT OF THE CITY OF BARRIE EXPERIENCED PROBLEMS INCLUDING: (1) OPERATIONAL PROBLEMS IN TREATMENT DUE TO EXTREMELY HIGH AND VARIABLE BOD LOADS, (2) HIGH SUSPENDED SOLIDS LOADS RESULTING IN SLUDGE HANDLING PROBLEMS, (3) ODOR PROBLEMS, AND (4) EXCESSIVE MAINTENANCE OF THE SEWER DOWNSTREAM OF THE TANNERY. A COMPREHENSIVE PROGRAM OF WATER CONSERVATION WAS EMPLOYED AT THE TANNERY, RESULTING IN A 30% REDUCTION OF THE WASTE FLOW. THE DAILY VOLUME OF WASTE TO BE HANDLED STABILIZED AT 185,000 GALLONS. THE PLANT WAS DESIGNED FOR PRIMARY TREATMENT ONLY, INCLUDING SCREENING, FLOW EQUALIZATION, PREAERATION, SETTLING, SLUDGE REMOVAL AND STORAGE, SCUM REMOVAL, FLOW METERING, TANK TRUCK REMOVAL OF SCUM AND SLUDGE, AND DEWATERING. LIMITS ESTABLISHED FOR THE EFFLUENT WERE: (1) 300 PPM BOD; (2) 350 PPM SUSPENDED SOLIDS; (3) 100 PPM ETHER SOLUBLES; AND (4) PH RANGE OF 5.5 TO 9.5. FROM THE LIMITED DATA AVAILABLE SO FAR, FOR BOD AND SS THE RANGES ARE FROM 290 TO 600 PPM AND 300 TO 760 PPM RESPECTIVELY IN THE EFFLUENT. TOTAL COST OF THIS INSTALLATION WAS $195,000, WITH FINANCING ARRANGED BY THE CITY. MUCH IMPROVEMENT IN THE CITY TREATMENT PLANT HAS BEEN NOTED, WITH A REDUCTION IN SLUDGE HAULAGE FROM 15 TO 5 TRUCK LOADS PER DAY. (W71-08969).

REFERENCE LIST

00581. SIMULATION OF AMMONIA STRIPPING FROM WASTE WATER.

ROESLER, J.F.; SMITH, R.; EILERS, R.G.
JOURNAL OF THE SANITARY ENGINEERING DIVISION, 97(SA3), PROC PAPER 8182, P 269-286, 1971.

A COMPUTER PROGRAM THAT CAN BE USED FOR THE DESIGN AND SIMULATION OF AMMONIA STRIPPING AND FILM PACKED COOLING TOWERS WAS DESCRIBED. THE AMMONIA STRIPPING PORTION OF THE PROGRAM WAS EMBEDDED IN THE COOLING TOWER CIRCULATION IN ORDER THAT THE VARIATION OF HENRY'S LAW CONSTANT WITH WATER TEMPERATURE COULD BE TAKEN INTO ACCOUNT. THE LOGIC OF THE PROGRAM WAS ARRANGED FOR: (1) DESIGN OF COOLING TOWERS; AND (2) FOR DESIGN OF AMMONIA STRIPPING TOWERS WITH TEMPERATURE CORRECTION. TWO TOWER CONFIGURATIONS WERE INCLUDED IN THE PROGRAM: (1) COUNTERCURRENT IN WHICH THE LIQUID FLOWS DOWN AND THE AIR MOVES UPWARD; AND (2) CROSSCURRENT IN WHICH THE LIQUID FLOWS DOWN AND THE AIR MOVES HORIZONTALLY AT RIGHT ANGLES TO THE FLOW OF THE LIQUID. REGRESSION EQUATIONS RELATING THE HEIGHT OF A TRANSFER UNIT AND GAS AND LIQUID FLOW RATES WERE DEVELOPED FROM PILOT AND FULL SCALE PLANT DATA. DETAILED CAPITAL AND OPERATING COST DATA WERE TAKEN FROM THE LITERATURE. THE COMPUTED RESULTS INDICATED THAT FOR A CROSSFLOW TOWER AN OPTIMUM GAS TO LIQUID RATIO IS ABOUT 1.75, AND FOR COUNTERFLOW THE OPTIMUM IS AT ABOUT 4. RELATIONS BETWEEN THE HEIGHT OF THE TOWER, PERCENT REMOVAL COST, AND INFLUENT FLOW WERE ALSO EXAMINED. IT WAS SHOWN THAT THE TOTAL TREATMENT COST LEVELS OFF BETWEEN 7 MGD AND 10 MGD. (W71-08998)

00582. AUTOMATIC PLANNING OF THE LEAST-COST WATER DISTRIBUTION NETWORK.

KALLY, E.
WATER AND WATER ENGINEERING, 75(902), 148-152, 1971.

WITH THE ADVENT OF ELECTRONIC COMPUTERS, THE PLANNING OF WATER DISTRIBUTION NETWORKS WAS RADICALLY CHANGED BY BEING MADE AN AUTOMATIC COMPUTER OPERATION AND BY PRODUCING THE MOST ECONOMIC AS WELL AS THE MOST EFFECTIVE SOLUTION TO THE PLANNER'S PROBLEM. TO ILLUSTRATE THIS PLANNING METHOD THE USE OF AN ELECTRONIC COMPUTER WAS NEEDED AND WAS BASED ON A COMBINATION OF 2 TECHNIQUES: (1) THE COMPUTATION OF THE HYDRAULIC DATA OF THE NETWORK BY THE HARDY CROSS METHOD, AND (2) FINDING THE OPTIMUM SOLUTION FOR A WATER SUPPLY NETWORK WITH THE AID OF LINEAR PROGRAMMING. THE RESULTS WERE THE FOLLOWING: (1) THE SPECIAL COMPUTER PROGRAMS-- THE 'NETWORK OPTIMIZER' -- PRODUCED CHEAPLY AND RAPIDLY THE BEST COST PLAN OF BOTH LOOPED AND TREE-LIKE NETWORKS; (2) IN THE CASE OF A TREE-LIKE NETWORK, THE OPTIMIZER SELECTED THE OPTIMAL (I. E. THE LEAST COST) PIPE ALIGNMENT (OUT OF A SET OF GIVEN POSSIBILITIES) AND ALSO DETERMINED THE OPTIMAL COMBINATION OF DIAMETERS; (3) IN A LOOPED NETWORK, WHERE THE ROUTES WERE FIXED, AND NONE OF THEM WAS TO BE ELIMINATED, THE OPTIMISER INDICATED THE BEST SELECTION OF PIPELINE DIAMETERS; AND (4) WHEN SOME OR ALL OF THE NETWORK INFLOWS WERE BOOSTED BY A PUMP, THE OPTIMAL PUMPING HEAD WAS ALSO DETERMINED BY THE OPTIMIZER, SO THAT THE WHOLE SET OF PIPELINE DIAMETERS PLUS INFLOW HEADS WAS AN OPTIMAL ONE. (W71-09223)

00583. ECONOMICS OF COMPOSTING MUNICIPAL REFUSE IN EUROPE AND ISRAEL.

KUPCHIK, G.J.
PROCEEDINGS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS JOURNAL OF THE SANITARY ENGINEERING DIVISION, PROCEEDINGS OF ASCE, 92(SA6), 41-56, 1966.

THIS REPORT CAME FROM A SURVEY OF VARIOUS COMPOSTING SYSTEMS USED IN EUROPE AND ISRAEL, UNDER DIFFERENT CLIMATIC, ECONOMIC, AND SOCIAL CONDITIONS, BY THE AUTHOR IN 1965. THE MOST COMMON COMPOSTING PROCESSES ARE VAN MAANEN PROCESS, RASPING SYSTEM, VENTILATED CELL COMPOSTING, DANO SYSTEM, AND BUHLER SYSTEM. COST AND INCOME DATA COLLECTED FROM 14 COMPOSTING PLANTS INCLUDED AMORTIZATION, INTEREST, RESERVE FUND, LAND RENTAL, PERSONNEL, UTILITIES, MAINTENANCE AND REPAIRS, DISPOSAL OF REJECTS, MISCELLANEOUS COSTS, SALVAGE, AND COMPOST PRODUCTION AND SALES. COST ANALYSIS WAS MADE TO DETERMINE FACTORS FAVORING SUCCESSFUL OPERATION. TABULATED DATA WERE COSTS OF PROCESSING RAW REFUSE, COSTS OF PROCESSING RAW REFUSE UTILIZING DIFFERENT COMPOSTING SYSTEMS, PRODUCTION AND SALE OF COMPOST, AND COMPARISON OF COSTS FOR PULVERIZING AND COMPOSTING RAW REFUSE. APPLICABILITY OF COMPOSTING REFUSE TO THE UNITED STATES WAS DISCUSSED. ADDITIONAL RESEARCH AND DEMONSTRATION PROJECTS IN REFUSE DISPOSAL METHODS ARE URGENTLY NEEDED. (W71-09417)

00584. ALTERNATIVE METHODS FOR PHOSPHORUS REMOVAL.

BRUNNER, C.A.
PROCEEDINGS, PITTSBURGH SANITARY ENGINEERING CONFERENCE, 8, PITTSBURGH, PENNSYLVANIA, NUTRIENT REMOVAL AND ADVANCED WASTE TREATMENT, FEB 1970, P 131-134.

THE THREE MAJOR PHOSPHORUS REMOVAL MECHANISMS DISCUSSED ARE: (1) SORPTION ON ACTIVATED ALUMINA; (2) PRECIPITATION WITH LANTHANUM SALTS; AND (3) ANION EXCHANGE. ABSORPTION HAS BEEN MORE EXTENSIVELY INVESTIGATED. PHOSPHORUS IS THE ONLY NUTRIENT REMOVED, AND A PRELIMINARY COST ESTIMATE IS 5-6 CENTS/1000 GALLONS, BASED UPON REGENERATION OF THE ALUMINA, AND LIME PRECIPITATION OF THE ELUTED PHOSPHATE AND OTHER IMPURITIES ALLOWING RE-USE OF THE NAOH REGENERANT. LANTHANUM PRECIPITATES ONLY ORTHOPHOSPHATES, AND USING A LA: P RATIO OF 1: 1, RESIDUAL P CONCENTRATIONS OF .01 MG/L CAN BE OBTAINED AT PH BETWEEN 5 AND 9.0. SUFFICIENT LANTHANUM HYDROLYSIS TAKES PLACE TO PREVENT ANY LANTHANUM FROM BEING LOST IN THE EFFLUENT. A RECOVERY METHOD FOR RECOVERING THE EXPENSIVE LANTHANUM MUST BE DEVELOPED, IF SUCH A RECOVERY SCHEME EXISTS, BEFORE THE PROCESS BECOMES ECONOMICALLY FEASIBLE. ANION EXCHANGE COLUMNS HAVE THE CAPABILITY TO REMOVE BOTH PHOSPHORUS AND NITROGEN. PRESENCE OF OTHER ANIONS IN DOMESTIC WASTE WATER WAS SHOWN TO HAVE NO EFFECT ON THE RATE AT WHICH NITROGEN AND PHOSPHORUS ION WERE EXCHANGED. HOWEVER, LIME PRECIPITATION OF THE REGENERANT WOULD REMOVE ONLY THE PHOSPHATES CAUSING A NITROGEN BUILDUP, NECESSITATING DISPOSAL OF SOME OF THE BRINE, AND RESULTANT DISPOSAL PROBLEMS. PRELIMINARY COST ESTIMATES HAVE SET COSTS FOR ANION EXCHANGE AT 10 CENTS/1000 GALLONS FOR A 10 MGD PLANT. PILOT SCALE STUDIES ARE CONTINUING TO PROVIDE MORE ACCURATE INFORMATION. (W71-09454)

COST ANALYSIS OF WATER POLLUTION CONTROL

00585. REUSE AND DISPOSAL OF ALUM AND LIME SLUDGES.

DEAN, R.B.
PROCEEDINGS, PITTSBURGH SANITARY ENGINEERING CONFERENCE, 8, PITTSBURGH, PENNSYLVANIA, FEB 1970, P 135-145.

BOTH LIME AND ALUM PRECIPITATION REACTIONS PRODUCE SLUDGE WHICH MUST BE HANDLED IN SOME MANNER. FIRST OF ALL, THE CHOICE MUST BE MADE AS TO WHETHER THE SLUDGE IS TO BE DISPOSED OF OR TREATED FOR RE-USE OF THE CHEMICALS IN IT. 250 MG/L OF LIME PRODUCES 500-600 MG/L OF SLUDGE WITH AN UNDERFLOW CONCENTRATION OF 2-3% OR 2 TONS OF SLUDGE SOLIDS PER MGD. THIS SLUDGE MAY BE USED FOR SOIL STABILIZATION, FILL FOR ROADS, OR IN AGRICULTURE. HOWEVER, BY HEATING THE PRECIPITATED CALCIUM CARBONATE, CALCIUM OXIDE CAN BE RECOVERED AND RE-USED. THE COST OF LIME RECOVERY IS THE SAME AS THE COST OF NEW LIME, BUT DISPOSAL COSTS ARE SIGNIFICANTLY REDUCED. COSTS REPORTED FROM DAYTON, OHIO, ARE $10-$12 PER TON, WHILE THE LAKE TAHOE PLANT REPORTS LIME RECOVERY AS COSTING $20/TON. THE RESULTS OF TESTING 4 LABORATORY SCALE, 75 LITER TREATMENT SYSTEMS ARE REPORTED AND COMPARED WITH REGARD TO PHOSPHATE REMOVAL, SLUDGE DEWATERABILITY, SLUDGE FILTERABILITY, AND SLUDGE COMPOSITION. ALUM SLUDGES CONTAIN 2 AL. 1P AND PROBABLY SOME CA PLUS SOME ORGANIC MATTER. THE SLUDGE WILL SETTLE TO 10% SOLIDS, AND IS AMENABLE TO CONCENTRATION BY FREEZING. THE SLUDGE IS NOT BIODEGRADABLE, AND CAN SOMETIMES CAUSE CLOGGING OF THE SOIL WHEN DISPOSED ON THE LAND. LIME TREATED ALUM SLUDGE CAN BE FILTER PRESSED TO REMOVE IN EXCESS OF 50% AS SOLUBLE ALUMINATE, HOWEVER, INCINERATION OF ALUM SLUDGE LEAVES LITTLE OR NO RESIDUE FOR DISPOSAL, SO FOR ALUM, DISPOSAL MAY BE LESS EXPENSIVE THAN RE-USE. (W71-09455)

00586. NITROGEN REMOVAL BY BREAKPOINT CHLORINATION.

BISHOP, D.F., PRESSLEY, T.A.
PROCEEDINGS, PITTSBURGH SANITARY ENGINEERING CONFERENCE, 8, PITTSBURGH, PENNSYLVANIA FEB 1970, P 239-247.

AMMONIA OXIDATION BY 'BREAKPOINT' CHLORINATION PROVIDES A PHYSICAL-CHEMICAL MEANS FOR REMOVING AMMONIA AND COMPLETING THE NATURAL NITROGEN CYCLE (I. E., OXIDATION OF THE AMMONIA TO N_2). CHLORINE IS ADDED TO THE AMMONIA WATER UNTIL CHLORINE RESIDUAL HAS REACHED A MINIMUM AND AMMONIA NITROGEN HAS ENTIRELY DISAPPEARED. THIS METHOD HAS BEEN USED FOR MANY YEARS IN THE WATER INDUSTRY AND HAS BEEN FOUND TO BE PH DEPENDENT, WITH EFFICIENT BREAKPOINTING OCCURRING ONLY AT PH 7-8.5 IN NATURAL WATER. NON-AMMONIA CHLORINE DEMAND MAY CALL FOR A CHLORINE TO AMMONIA-NITROGEN WEIGHT RATIO OF 15 TO 1 OR GREATER. DISADVANTAGES OF THE METHOD INCLUDE: (1) SATISFACTORY NITROGEN REMOVALS MAY NOT BE ACHIEVED IF GREATER THAN 1 MG/I OF PERMANENT RESIDUAL NITROGEN COMPOUNDS OCCUR SUCH AS NO_3^-, (2) LARGE CHLORINE DOSES PRODUCE MORE ACID BY CHLORINE HYDROLYSIS THAN CAN BE NEUTRALIZED BY MOST WASTE WATERS, NECESSITATING THE ADDITION OF CAUSTIC TO MAINTAIN A FAVORABLE PH RANGE; (3) HIGH CHLORINE DEMANDS REQUIRE INCREASED SUPPLIES OF STORED CHLORINE WHICH REPRESENT A POTENTIALLY HAZARDOUS CONDITION, AND (4) AT CHLORINE COSTS OF $0.05/LB AND A 200 MG/I DOSE, THE COST FOR THE CHLORINE ALONE IS 8.3 CENTS/1000 GALLONS. HOWEVER, IF PILOT PLANT STUDIES ESTABLISH THAT ACCEPTABLE REMOVALS CAN BE OBTAINED, ON-SITE CHLORINE GENERATION FROM BRINES, WHICH PRODUCES BOTH CHLORINE AND CAUSTIC, MAY OVERCOME THE CAUSTIC AND STORAGE PROBLEMS IN LARGE PLANTS. THE OPERATION SIMPLICITY ALONE RECOMMENDS THE METHOD FOR SMALL PLANTS. (W71-09462).

00587. AEROBIC SECONDARY TREATMENT OF POTATO PROCESSING WASTES.

WATER POLLUTION CONTROL RESEARCH SERIES, DEC 1970. 110 P.

THE R. T. FRENCH COMPANY, OF SHELLEY, IDAHO, HAS DEMONSTRATED THE FEASIBILITY OF USING A COMPLETE MIX ACTIVATED SLUDGE UNIT FOR SECONDARY TREATMENT OF POTATO PROCESSING WASTES. DURING THE 1969-1970 PROCESSING SEASON, BOTH THE ACTIVATED SLUDGE PROCESS AND A FLOW-THROUGH AERATION PROCESS WITHOUT SECONDARY CLARIFICATION WERE STUDIED. THE ACTIVATED SLUDGE UNIT WAS DEMONSTRATED TO BE CAPABLE OF BOD REMOVALS, IN EXCESS OF 90% OVER EXTENDED PERIODS, WITH COLIFORM REMOVALS IN EXCESS OF 96%. WITH THE FLOW-THROUGH SYSTEM, BOD REMOVALS RANGED BETWEEN 70 AND 80%. ANALYSIS OF DATA OBTAINED REVEALED THAT BOTH THE QUANTITY OF EXCESS SLUDGE PRODUCED AND THE AMOUNT OF OXYGEN REQUIRED WERE FUNCTIONS OF THE BOD REMOVAL RATE AND THE MIXED LIQUOR VOLATILE SUSPENDED SOLIDS CONCENTRATION. THE SUBSTRATE REMOVAL RATE COEFFICIENT WAS SHOWN TO BE TEMPERATURE DEPENDENT. THE PREVAILING LOW AIR TEMPERATURES AT THE SHELLY LOCATION DID NOT CAUSE SYSTEM FAILURE, BUT DATA OBTAINED DEMONSTRATED THE NEED TO CONSIDER TEMPERATURE LOSS IN SYSTEM DESIGN. TOTAL ANNUAL TREATMENT COSTS, EXCLUSING COSTS FOR WASTE ACTIVATED SLUDGE DISPOSAL, WERE ESTIMATED TO BE $.038 PER LB BOD APPLIED, AND $.021 PER LB COD APPLIED. OPERATION OF THICKENER-CLARIFIER ON COMBINATIONS OF SILT AND BIOLOGICAL SOLIDS WAS NOT SUCCESSFUL. FAILURES WITH THIS UNIT DEMONSTRATED A NEED FOR THE DEVELOPMENT OF SPECIAL SILT REMOVAL AND HANDLING EQUIPMENT FOR POTATO PROCESSING. (PB-200 623) (W71-09526).

00588. A TECHNIQUE FOR IRRIGATING BOTTOM LAND HARDWOOD TREES WITH PAPERMILL EFFLUENT IN NORTH LOUISIANA.

AHMED, I.
MASTER'S THESIS, MAY 1970. 68 P.

BOTTOM LAND HARDWOOD TREES IN LOUISIANA WERE IRRIGATED WITH BOTH BLACK WATER AND WHITE WATER EFFLUENTS FROM LOCAL PAPERMILLS. ANALYSES WERE PERFORMED ON THE WATERS TO DETERMINE THE INDIVIDUAL CONSTITUENTS AND CHARACTERISTICS OF EACH. WHITE WATER WAS FOUND TO BE PREDOMINANTLY SODIUM, WHILE THE MAJOR COMPONENT OF BLACK WATER WAS FOUND TO BE SODIUM BICARBONATE. AVERAGE ANNUAL PRECIPITATION FOR THE AREA WAS FOUND TO BE 53 INCHES PER YEAR. TESTS WERE CONDUCTED, WHICH ESTABLISHED 19.3 INCHES/YEAR THE MAXIMUM PERMISSIBLE AMOUNT OF MILL EFFLUENT AND MIXED 9 PARTS OF WHITE WATER TO 1 PART OF BLACK WATER, WHICH COULD BE USED TO IRRIGATE THE FORESTS TO OBTAIN OPTIMUM GROWTH. THE OPTIMUM GROWTH RECORDED WAS 6.03% PER YEAR. TREES WOULD BE IRRIGATED FROM APRIL THROUGH SEPTEMBER, THE TIME WHEN MOST TREE GROWTH OCCURS. BASED ON A LIFE EXPECTANCY OF 20 YEARS, THE COST OF THE PROJECT WAS DETERMINED TO BE $7.43 PER ACRE PER YEAR. FURTHER RESEARCH IS NEEDED IN THE FORM OF A TREE-IMPROVING PROGRAM TO DETERMINE THE OPTIMUM

TREE SPECIES FOR THIS PARTICULAR APPLICATION. VARYING PROPORTIONS OF WHITE WATER TO BLACK WATER SHOULD ALSO BE EXPERIMENTED WITH IN ORDER TO ACHIEVE OPTIMAL CONDITIONS THROUGHOUT THE SYSTEM. (W71-09527).

00589. TREATMENT OF WASTES FROM FOOD MANUFACTURE AND COFFEE PROCESSING.

CHALMERS, R.K.
PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 22, 52(2), 866-878, 1968.

WHEN AN ENGLISH GENERAL FOODS FACTORY WAS MOVED FROM A LARGE CITY TO A SMALL TOWN, IT WAS FACED WITH THE NEED FOR A MEANS OF TREATING WASTE, ESPECIALLY FROM COFFEE MANUFACTURE, WHICH COULD NOT BE TREATED IN THE EXISTING SEWAGE DISPOSAL WORKS AT THE NEW SITE, BANBURY, WARWICKSHIRE. AFTER INVESTIGATING POSSIBLE TREATMENT METHODS, IT WAS DECIDED THAT PHYSICAL MEANS OF REDUCING THE EFFLUENT WOULD BE MOST ADVANTAGEOUS. THE TREATMENT USED WAS PRIMARILY BASED ON SEGREGATION OF THE WEAK EFFLUENT AND THE STRONG EFFLUENT WHICH CONTAINED THE WASTE FROM THE COFFEE PLANT. THE PRODUCT OF THE TREATMENT WAS SATISFACTORILY BELOW THE MAXIMUMS SET PREVIOUSLY BY BANBURY AUTHORITIES. THE PLANT ORIGINALLY COST 220,000 POUNDS WITH AN OPERATING COST OF 50,000 POUNDS PER YEAR. (W71-09545).

00590. FOOD CANNERY WASTE TREATMENT BY LAGOONS AND DITCHES AT SHEPPARTON, VICTORIA, AUSTRALIA.

PARKER, C.D.
PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 50(2), 284-302, 1966.

CANNERY WASTE IS CHARACTERIZED BY HIGH BOD AND HIGH ACIDITY. THE USUAL METHOD OF TREATMENT IS SPRAY OR FLOOD IRRIGATION OR AEROBIC TYPE LAGOONS WTIH HEAVY DOSAGE OF SODIUM NITRATE FOR ODOR CONTROL. IN SHEPPARTON, VICTORIA, EXPANSIONS IN THE FACILITIES OF SHEPPARTON PRESERVING COMPANY, THE LARGEST CANNERY IN THE SOUTHERN HEMISPHERE, AND THE BUILDING OF A SOUP CANNERY IN THE AREA CAUSED PROBLEMS IN THE TREATMENT OF THE RESULTING SEWAGE. THERE WAS A PRESSING NEED FOR AN EFFICIENT MEANS OF PURIFYING, WITHOUT CAUSING NUISANCE, THE LARGE SEASONAL FLOWS OF HIGHLY POLLUTED FOOD WASTES FROM TWO CANNERIES ON AREAS CLOSELY ADJACENT TO A PROSPEROUS AND RAPIDLY DEVELOPING URBAN CENTER. THE SHORT SEASONAL NATURE OF CANNERY OPERATIONS AND CONSEQUENT HIGH CAPITAL COST MADE THE PROBLEM EVEN MORE DIFFICULT. IT WAS DECIDED TO EXPERIMENT WITH ANAEROBIC AND AEROBIC TYPE LAGOONS AND OXIDATION DITCHES. THE WASTE FROM EACH FIRM IS MIXED WTIH SEWAGE PLANT EFFLUENT AND TREATED IN THE NEW PROCESSING UNIT WITH VERY GOOD RESULTS WHICH ARE DESCRIBED IN GREAT DETAIL. THE TOTAL COST OF THE NEW UNIT, EXCLUSING THE COST OF INFLOW AND OUTFLOW PIPELINES AND LABOR AND MAINTENANCE, WAS $155,000 TO THE PRESERVING CO., AND $143,000 (AMERICAN DOLLARS) TO THE SOUP CANNERY PLUS ANNUAL COSTS OF $5,364 AND $8,192 RESPECTIVELY, EXCLUDING PIPELINES, PUMPING STATIONS, AND MAINTAINANCE LABOR. THE NET RESULT WAS ALMOST COMPLETE PURIFICATION AT COSTS THE INDUSTRIES COULD ACCEPT. (W71-09548).

00591. THE APPLICATION OF BACTERIAL PROCESS KINETICS IN STREAM SIMULATION AND STREAM ANALYSIS.

GATES, W.E.; MARLAR, J.T.; WESTFIELD, J.D.
WATER RESEARCH, VOL 3, 663-686, 1969.

THREE SURFACTANT AND SURFACTANT-CATALYST SYSTEMS WERE STUDIED TO DETERMINE TEIR FEASIBILITY FOR REMOVAL OF H2S FROM SOUR WATER, AND THE RECOVERY OF ELEMENTAL SULFUR. THE SURFACTANTS CHOSEN FOR STUDY WERE THOSE KNOWN TO BE CAPABLE OF FORMING INTERMEDIATES IN THE OXIDATION IN THE PRESENCE OF OXYGEN, OF H2S TO SULFUR. THE SURFACTANTS GENERATED A STABLE FOAM WHICH WAS REMOVED AND COLLECTED. THE PRECIPITATED SULFUR WAS REMOVED BY FILTERING THE FOAMATE. THE SURFACTANT WAS THEN RECYCLED TO THE PROCESS AND REUSED. THESE SYSTEMS WERE SHOWN TO BE CAPABLE OF REDUCING THE HYDROGEN SULFIDE TO LESS THAN .1 PPM WHILE LEAVING 40 TO 80 PPM OF RESIDUAL SURFACTANT IN THE EFFLUENT. THE RESIDUAL SURFACTANT, SINCE THE SURFACTANTS USED WERE ALL BIODEGRADABLE, PRESENTED NO HAZARD TO RECEIVING WATERS, BUT COST OF REPLACEMENT OF THE AMOUNT LOST WAS EXCESSIVE. MAXIMUM SULFUR RECOVERY WAS 16% BY WEIGHT, UNDER THE CONDITIONS OF THE INVESTIGATION UNDER THE BEST POSSIBLE OPERATING CONDITIONS (16% WT SULFUR RECOVERY AND 40 PPM SURFACTANT IN EFFLUENT), THE OPERATING EXPENSE WAS DETERMINED TO BE 3.5 MIL/BBL OF (200 PPM H2S) SOUR WATER TREATED. (W71-09553).

00592. ECONOMIC DETERMINANTS FOR SEDIMENT MANAGEMENT ON A NORTH MISSISSIPPI WATERSHED.

COSPER, H.R.
CONFERENCE HELD APRIL 13-14, 1971, VICKSBURG, WATER RESOURCES RESEARCH INSTITUTE, MISSISSIPPI STATE UNIVERSITY, P 29-40, 1971.

STUDIES PERTAINING TO ECONOMIC AND PHYSICAL RELATIONSHIPS WITHIN A WATERSHED ACRE CONDUCTED ON A 117-SQUARE-MILE SECTION OF THE PIGEON ROOST CREEK WATERSHED IN NORTH MISSISSIPPI. THE PRINCIPAL EMPHASIS FOR MANAGEMENT AND CONTROL OF SEDIMENT IN THE PIGEON ROOST CREEK WATERSHED OF NORTH MISSISSIPPI WAS ON RETAINING THE SEDIMENT ON THE WATERSHED. THIS WAS DONE BY ARTIFICIAL BARRIERS TO TRAP AND RETAIN THE SEDIMENT, AND LAND USE CHANGES TO REDUCE AND PREVENT FURTHER SOIL LOSSES OFF THE WATERSHED. THE NECESSARY ECONOMIC DETERMINANTS REQUIRED TO ASSESS ECONOMIC EFFICIENCY INCLUDE NOT ONLY THE DIRECT CAPITAL INVESTMENTS BUT ALSO ANY ECONOMIC ADJUSTMENTS IN THE FARMING ENTERPRISE. AVERAGE TOTAL DIRECT CAPITAL COST WAS $8.95 PER WATERSHED ACRE FOR THE 74,900 ACRES. SEDIMENT-RETARDING STRUCTURES ACCOUNTED FOR $4.61 PER ACRE, AND THE REFORESTATION PROGRAM FOR $4.34. THE INCREASE IN FORESTED ACRES WAS NOT AN ECONOMIC COST BECAUSE THIS LAND HAD PREVIOUSLY BEEN IDLE. ALSO, THERE WERE NO ECONOMIC ADJUSTMENTS MADE ON CULTIVATED LANDS TO SPECIFICALLY ACCOMMODATE SEDIMENT MANAGEMENT. (W71-09632).

COST ANALYSIS OF WATER POLLUTION CONTROL

00593. WHAT DO WE MEAN BY POLLUTION.

GRATTO, C.

33RD ANNUAL FORUM, NATIONAL FARM INSTITUTE, FEB 1971, DES MOINES, IOWA, P 1-6.

PROBLEMS OF ENVIRONMENTAL QUALITY WOULD BE EASIER TO SOLVE IF WE KNEW THE TOLERABLE LEVELS OF CONCENTRATION FOR ALL KINDS OF MATTER AND ENERGY THAT ARE RELEVANT TO MANAGING THE ENVIRONMENT. PUBLIC POLICIES FOR REACHING A DESIRED LEVEL OF QUALITY INCLUDE LEARNING, FINES AND PENALTIES, THE ADVERSARY SITUATION, INDUCEMENTS AND COOPERATION, TAXATION, AND THE PRICE SYSTEM. (W71-09753).

00594. ECONOMICS OF POLLUTION CONTROL.

TIMMONS, J.F.

33RD ANNUAL FORUM, NATIONAL FARM INSTITUTE, FEB 1971, DES MOINES, IOWA, P 77-85.

THE PAPER SUGGESTS SOME IDEAS AND METHODS THAT APPEAR USEFUL IN UNDERSTANDING AND IN RESOLVING SOME OF THE DIFFICULT BUT IMPORTANT ISSUES EMANATING FROM THREE ENVIRONMENTAL QUALITY QUESTIONS. FIRST, WHAT ARE THE STANDARDS OF ENVIRONMENTAL QUALITY THAT CAN SERVE AS POLICY AND PROGRAM GOALS AND AT THE SAME TIME ENGENDER WIDESPREAD AND CONTINUING PUBLIC UNDERSTANDING AND SUPPORT. NEXT, WHAT ARE THE COSTS, BOTH MONETIZED AND NON-MONETIZED, OF BOTH ACHIEVING AND FAILURE TO ACHIEVE THE STATED STANDARDS OF ENVIRONMENTAL QUALITY. THIRDLY, WHO PAYS THE COSTS BOTH WITH AND WITHOUT ACHIEVEMENT OF THE STANDARDS OF ENVIRONMENTAL QUALITY AND WHO GETS THE BENEFITS. (W71-09761).

00595. AGRICULTURAL BENEFITS FROM URBAN POLLUTION CONTROL.

SHAEFFER, J.R.

33RD ANNUAL FORUM, NATIONAL FARM INSTITUTE, FEB 1971, DES MOINES, IOWA, P 101-107.

A PILOT WASTE WATER MANAGEMENT SCHEME FOR MUSKEGON COUNTY, MICHIGAN, IS OUTLINED. SEWAGE IS FIRST PUMPED TO THE SURROUNDING COUNTRYSIDE WHERE TREATMENT CALLS CONVERT THE WASTE TO AN ODORLESS CLEAR LIQUID BY USING ALL THE FORCES OF NATURE - AIR, AEROBIC BACTERIA, GRAVITY, SUNLIGHT, AND TIME. THE LIQUID IS THEN USED AS IRRIGATION WATER AND THE SOIL REMOVES THE REMAINING NUTRIENTS, HEAVY METALS, AND VIRUSES. AN UNDER DRAINAGE SYSTEM PICKS UP THE PURE WATER AND BRINGS IT TO A STREAM. FOR 42 MILLION GALLONS OF MUSKEGON COUNTY SEWAGE A DAY, 10 THOUSAND ACRES OF LAND WERE NEEDED. THE COSTS FOR THE NEW SYSTEM ARE LESS THAN BRINGING THE EXISTING PLANTS UP TO A SECONDARY LEVEL OF TREATMENT. (W71-09764).

00596. ALTERNATIVE OXYGENATION POSSIBILITIES FOR LARGE POLLUTED RIVERS.

WHIPPLE, W JR; YU, S.L.

WATER RESOURCES RESEARCH 7(3), 566-579, 1971.

THIS PAPER DESCRIBES TESTS OF AERATION EQUIPMENT ON A MAJOR RIVER, THE DELAWARE ESTUARY, AND DISCUSSES TRANSFER EFFICIENCY, SUITABLE AERATOR SYSTEM DESIGN, AND COST COMPARISONS. NAVIGATIONAL CONSIDERATIONS AND DEEPER, MORE TURBULENT WATER CAUSE DESIGN REQUIREMENTS FOR LARGE RIVERS TO DIFFER CONSIDERABLY FROM THE REQUIREMENTS FOR SMALL RIVERS. REINFORCED AERATORS AT THE SURFACE APPEAR FAVORABLE FOR UNCROWDED RIVER AREAS, BUT AIR DIFFUSERS ON THE BOTTOM APPEAR MORE PRACTICABLE AND COMPARABLY ECONOMICAL FOR PORT AREAS. DIFFUSERS CAN BE PLACED ONLY ON CHANNEL MARGINS AND ANCHORAGE AREAS, BUT DISPERSION STUDIES INDICATE THAT THE OXYGENATED WATER WILL STILL REACH THE CENTER OF THE RIVER WITHIN A REASONABLE DISTANCE. THE COST OF ADDING ONE UNIT OF DISSOLVED OXYGEN BY AERATION DEVICES APPEARS TO BE JUST ABOUT ONE-FOURTH THAT OF ADDING IT BY WASTE TREATMENT ONLY. THERE ARE POSSIBILITIES OF LOWERING COSTS FURTHER BY USING OXYGEN DIFFUSERS. (W71-09821).

00597. PUBLIC WATER SUPPLY SYSTEMS.

PUBLIC FACILITY NEEDS, WASHINGTON, US GOVERNMENT PRINT OFFICE, 1966, P 105-124.

THE NATURE AND COMPOSITION OF THE INDUSTRY IS BROKEN DOWN INTO A DESCRIPTION OF THE PHYSICAL CHARACTERISTICS, THE SERVICES RENDERED, THE STANDARDS OF PERFORMANCE, AND THE EXISTING CAPITAL PLANT. THE COSTS AND USER CHARGES ARE THEN DEALT WITH, PARTICULAR ATTENTION BEING GIVEN TO CONSTRUCTION COSTS, INCREMENTAL COSTS OF WATER FACILITIES, TYPICAL WATER UTILITY COST INDEXES, PLANT INVESTMENT, AND ANNUAL EXPENSE OF OPERATIONS AND MAINTENANCE. THE WATER UTILITY FINANCING AND USER CHARGES INCORPORATE EXPLANATIONS OF BOTH SELF-SUPPORTING ENTERPRISES AND TAX-SUPPORTED ENTERPRISES. TRENDS IN CAPITAL OUTLAYS ARE INDICATED, AND PROJECTIONS ARE MADE FOR WATER INDUSTRY NEEDS AND PROSPECTIVE CAPITAL OUTLAYS, IN TERMS OF POPULATION GROWTH, DEPRECIATION, DEFICIENCIES, WATER RATES, PRIVATE INVESTMENT CAPITAL, AND FEDERAL ASSISTANCE PROGRAMS IN THE FUTURE. (W71-09867).

00598. THE USE OF STANDARDS AND PRICES FOR PROTECTION OF THE ENVIRONMENT.

BAUMOL, W.J.; OATES, W.E.

SWEDISH JOURNAL OF ECONOMICS, 73(1), 42-54, 1971.

THE OPTIMALITY PROPERTIES AND OTHER ADVANTAGES OF A PROPOSED PRICING PROCEDURE ARE PRESENTED, AND IT IS INDICATED TAHT THIS PARTICULAR METHOD WILL ACHIEVE THE DESIRED REDUCTION IN POLLUTION AT MINIMUM COST TO THE ECONOMY. THE PRICING AND STANDARDS METHOD PROPOSED IS CONTRASTED WITH THE PIGOUVIAN TECHNIQUE OF IMPOSITION OF TAXES OF SUBSIDIES ON EXTERNALITY-GENERATING ACTIVITIES, AND THE FORMER IS SHOWN TO BE MORE READILY WORKABLE FOR SOMEWHAT THE SAME EFFECT. PROJECTIONS FOR THE SUCCESS OF THE STANDARDS AND PRICING METHOD ARE MADE. (W71-09900).

00599. ENVIRONMENTAL CONTROL AND ECONOMIC SYSTEMS.

DAHMEN, E.

SWEDISH JOURNAL OF ECONOMICS, 73(1), 67-75, 1971.

THE CAUSE OF ENVIRONMENTAL POLLUTION IS INDUSTRIALIZATION AND THEREFORE IS PRESENT IN BOTH A CAPITALISTIC AND SOCIALISTIC ECONOMY. A MAJOR FACTOR IN THE FAILURE OF BOTH SYSTEMS TO COMBAT POLLUTION HAS BEEN INACCURATE COST CALCULATIONS, WHICH HAS BEEN RESPONSIBLE FOR MISALLOCATION OF RESOURACES AND ENVIRONMENTAL DETERIORATION. AC-

CURATE COST CALCULATIONS WOULD ENCOURAGE THE CHOICE OF TECHNOLOGICAL ALTERNATIVES FAVORABLE TO PRESERVING THE ENVIRONMENT. REGULATIONS ARE SUGGESTED AS AN ALTERNATIVE TO CHARGES FOR EFFECTIVE ENVIRONMENTAL POLICY COMPLIANCES. (W71-09902).

00600. EVALUATING URBAN CORE USAGE OF WATERWAYS AND SHORELINES.

WHITMAN, I.L.; DAVIS, R.M.; GOLDSTONE, S.E.; MOLHOLM, L; MILSTEAD, R.J.

BATTELLE, COLUMBUS LABORATORES, RESEARCH REPORT TO OFFICE OF WATER RESOURCES RESEARCH CONTRACT NUMBER 14-31-0001-3178, 92 PAGES, APRIL 30, 1971.

CLEVELAND'S WATER RESOURCES INCLUDE THE LAKE ERIE WATERFRONT AND THREE SMALL RIVERS, AROUND WHICH THE REGION'S MAJOR PARK SYSTEM IS DESIGNED. IN RELATION TO INNER CITY WATER-RELATED RECREATION, IT WAS FOUND THAT UNDER THE PRESENT SET OF INSTITUTIONAL AND LEGAL CONSTRAINTS RECREATION AGENCIES WOULD BE UNABLE TO IMPLEMENT NEW PROCEDURES IN RECREATION PLANNING FOR THE PURPOSE OF PROVIDING MORE EQUITABLE RECREATION OPPORTUNITIES TO THE RESIDENTS OF THE INNER CITY. A STRATEGY FOR INTRODUCING NEW RECREATION PLANNING METHODS IN THE CLEVELAND SYSTEMS WAS RECOMMENDED. THE BROAD SUBJECT OF 'SOCIAL QUALITY' AS IT MAY RELATE TO URBAN WATER DEVELOPMENT WAS DEFINED AND CONCEPTUALIZED. IT WAS CONCLUDED THAT ATTITUDES ON THE RELATIONSHIP IN OUR SOCIETY BETWEEN SOCIAL QUALITY AND URBAN WATER DEVELOPMENT MUST BE UNDERSTOOD IN ORDER TO FORM A BASIS FOR DEVELOPING WATER RESOURCES FOR THE BENEFIT OF THE URBAN CORE CITIZEN. (PB-201 054) (W71-09940).

00601. MANAGEMENT OF ANIMAL FEEDLOT WASTES -- LAND SPREADING AS A DISPOSAL PROCESS.

SMITH, G.F

2ND COMPENDIUM OF ANIMAL WASTE MANAGEMENT, JUNE 1969, PAPER NO 4. 8 P.

DISPOSAL OF ANIMAL WASTE ONTO LAND IS EFFECTIVE AND CAN INCREASE CROP YEILDS. ATTENTION MUST BE GIVEN TO THE CONDITION OF THE WASTE AND SUPPLEMENTAL NUTRIENTS ADDED TO INSURE A BALANCED FERTILIZER PROGRAM. COST OF LAND DISPOSAL MAY EXCEED RETURNS IN TERMS OF CROP RESPONSE, HOWEVER LAND DISPOSAL CAN MINIMIZE ANIMAL WASTE DISPOSAL COSTS. (W71-10370).

00602. FEASIBILITY OF JOINT TREATMENT IN A LAKE WATERSHED.

WATER POLLUTION CONTROL RESEARCH SERIES, NOV 1969.113 P.

A FEASIBILITY STUDY TO DETERMINE THE PRACTICALITY OF JOINT TREATMENT OF MUNICIPAL AND INDUSTRIAL WASTEWATER WAS INITIATED IN ONONDAGA COUNTY, NEW YORK. THE PRIMARY POLLUTANT TO BE REMOVED WAS ORGANIC MATERIAL. TOTAL ORGANIC LOADS AT BOTH THE LEY CREEK AND THE MUNICIPAL PLANT WERE EQUAL, BUT FLOW TO THE MUNICIPAL SEWAGE TREATMENT PLANT WAS NEARLY THREE TIMES AS GREAT AS THE FLOW TO LEY CREEK. THE MUNICIPAL SEWAGE TREATMENT PLANT WAS CHOSEN AS THE OUTFALL BECAUSE OF GREATER DILUTION CAPACITY OF ONONDAGA LAKE. ACTIVATED SLUDGE TREATMENT OF THE PRIMARY EFFLUENT OF BOTH PLANTS WAS SHOWN TO BE FEASIBLE, WITH THE LEY CREEK SEWAGE TREATMENT PLANT DESTINED FOR EVENTUAL PHASING-OUT. COST ESTIMATES FOR DIFFERENT SYSTEM CONFIGURATIONS (CONVENTIONAL ACTIVATED SLUDGE, CONTACT STABILIZATION, ETC.) RANGED FROM $23,000-$30,000 FOR CAPITAL COST AND $3,700-$4,400/YEAR FOR OPERATION AND MAINTENANCE. THE FULL-SCALE JOINT TREATMENT OPERATION WAS FORECAST TO BE ABLE TO OBTAIN IN EXCESS OF 85% BOD REMOVAL DURING WINTER OPERATION. (PB-201 698) (W71-10650).

00603. POLYMERIC MATERIALS FOR TREATMENT AND RECOVERY OF PETROCHEMICAL WASTES.

KLEIN, E.; DESAI, S.V.; SMITH, J.K.; WEAVER, R.E.C.

WATER POLLUTION CONTROL RESEARCH SERIES, MARCH 1979, 68 P.

THREE OPERATIONAL MODES FOR REMOVING GLYCERIN FROM WASTE STREAMS BY REVERSE OSMOSIS WERE EXAMINED: (1) A SINGLE-STAGE REVERSE OSMOSIS UNIT; (2) A THREE-BATTERY MULTI-STAGE UNIT WITH FORWARD FEED OF THE RAFFINATE TO SUBSEQUENT REVERSE OSMOSIS RECOVERY BATTERIES; AND (3) AN ALTERNATE TWO BATTERY MULTI-STAGE COUNTER-CURRENT RECOVERY UNIT. ANALYSIS OF A TYPICAL MULTI-STAGE FORWARD FEED OPERATION REVEALED AN ESTIMATED CAPITAL COST OF $133,600, ANNUAL OPERATING EXPENSES OF $20,700, AND A TOTAL YEARLY CREDIT FROM A 10 YEAR BASE DEPRECIATION AND SALE OR RE-USE OF THE GLYCERIN RECOVERED OF $75,610. PAYOUT FOR THE OPERATION WAS 3.8 YEARS AT A 26% RATE OF RETURN, MAKING IT AN EXTREMELY FAVORABLE INVESTMENT. (PB-201 699) (W71-10651).

00604. DEMONSTRATE FEASIBILITY OF THE USE OF ULTRASONIC FILTRATION IN TREATING THE OVERFLOWS FROM COMBINED SEWERS.

ACOUSTICA ASSOCIATES, INC., LOS ANGELES, CALIF., FINAL REPORT SEPTEMBER 22, 1969, 86 P.

THE FEASIBILITY, BOTH ECONOMIC AND TECHNICAL, OF USING ULTRASONIC FILTRATION AS AN AID TO REMOVING SUSPENDED IMPURITIES WAS INVESTIGATED. INPUTS TO THE TEST APPARATUS INCLUDED DRINKING WATER, SIMULATED SEWAGE, PRIMARY AND SECONDARY SEWAGE EFFLUENTS, ALGAE POND EFFLUENT, COARSELY SCREENED, RAW SEWAGE DILUTED 2: 1, 5: 1, AND 10: 1 WITH SIMULATED STORM DRAINAGE, AND DELIVERATELY CONCENTRATED RAW SEWAGE. DIRT, SAND, AND LEAVES WERE ADDED IN SOME TEST RUNS WITH NO APPARENT EFFECT ON PERFORMANCE. SYSTEM PERFORMANCE WAS INTERMEDIATE BETWEEN THAT OF PRIMARY AND SECONDARY TREATMENT. OTHER BENEFITS INCLUDED: (1) APPLICATION OF ULTRASONIC ENERGY INCREASED THE TOTAL QUANTITY OF EFFLUENT FILTERED BETWEEN BACKWASH CYCLES FROM 4 TO 18 TIMES THAT TREATED WITH SIMILAR EQUIPMENT WITHOUT ULTRASONICS APPLIED; AND (2) APPLICATION OF ULTRASONIC ENERGY RESTORED THE FILTER ELEMENTS TO 'LIKE-NEW' CONDITION WITHOUT NECESSITATING FREQUENT FILTER REPLACEMENT. COST FIGURES FOR AN ULTRASONIC FILTRATION SYSTEM CAPABLE OF HANDLING 1.4 MGD, EXHIBITING PERFORMANCE MIDWAY BETWEEN PRIMARY AND SECONDARY TREATMENT, AND OCCUPYING ONLY SEVERAL HUNDRED SQUARE FEET, RANGED BETWEEN 2.8 AND 3.5 CENTS/1000 GALLONS. BY COMPARISON, COMBINED PRIMARY-SECONDARY TREATMENT COST FIGURES WERE REPORTED AS 10 CENTS/1000 GALLONS EXCLUDING

THE COST OF THE CONSIDERABLE AMOUNT OF LAND INVOLVED. (PBd201 745) (W71-10654).

00605. DESIGN AND COST OF LIQUID-WASTE DISPOSAL SYSTEMS.

HAYNES, C.D.; GRUBBS, D.M.
ALABAMA UNIVERSITY, NATURAL RESOURCES CENTER, AND ALABAMA GEOLOGICAL SURVEY REPORT, MAY 1970. 120 P.

ELEMENTS OF THE COST OF WASTE WATER INJECTION WELLS INCLUDE CAPITAL OUTLAY, MAINTENANCE, AND OPERATION. DESIGN IS CRITICAL TO INITIAL CAPITAL INVESTMENT AND IS A CONTRIBUTING FACTOR IN OTHER COST ELEMENTS. THE COMPUTER-DERIVED COST OF DEEP-WELL DISPOSAL SYSTEMS IS TEMPERED TO MEET THE PHYSICAL PARAMETERS DICTATED BY THE GEOLOGY OF ALABAMA. AN OBJECTIVE OF THE STUDY IS TO CONSERVE THE FRESH-WATER RESOURCE OF THE STATE IF FEASIBILITY OF THIS METHOD OF WASTE DISPOSAL CAN BE ESTABLISHED. VARIABLE SITE COST FACTORS INCLUDE DEPTH OF THE WELL, PHYSICAL PROPERTIES OF THE RECEPTIVE HORIZON, MECHANICAL LIMITATIONS OF THE WELL DESIGN AND EQUIPMENT, AND ALSO MANAGEMENT DECISIONS WITH REFERENCE TO INVESTMENT IN THE DISPOSAL WELL AND ITS COMPONENTS RELATED TO WASTE VOLUME AND ALTERNATE OR STANDBY DISPOSAL MEANS. A COMPUTER PROGRAM AFFORDS A FLEXIBLE PROCEDURE FOR DESIGN AND ESTIMATION OF COSTS OF DEEP-WELL DISPOSAL SYSTEMS. ALTHOUGH THE PROGRAM IS KEYED TO COSTS DICTATED BY THE GEOLOGY OF ALABAMA, IT IS APPLICABLE TO ANY AREA BY MODIFICATION OF TABLES PERTAINING TO DRILLING COSTS. (PB-194 113) (W70-09772).

00606. WATER WORKS RECORD KEEPING.

BOURLON, B.J.
PROCEEDINGS OF THE 42ND ANNUAL WATER AND POLLUTION CONTROL SCHOOL, OKLAHOMA STATE UNIVERSITY, NOVEMBER 18-22, 1968, STILLWATER (1969), P 71-81.

THIS ARTICLE BRIEFLY STATES THE REASONS FOR KEEPING RECORDS IN A MUNICIPAL WATER AND WASTE WATER TREATMENT DEPARTMENT. RECORDS SERVE AS A DATA SOURCE FOR ANALYSIS, PLANNING, AND CONTROL. RECORDS CAN BE KEPT IN THREE MAIN AREAS, PROGRESS, PLANNING, AND BUDGET SUPPORT. RECORDS SHOULD BE SIMPLE, CLEAR, CONCISE, AND SHOULD CONTAIN ALL NECESSARY AND PERTINENT DATA. UNUSED RECORDS ARE A WASTE OF TIME AND MONEY. RECORDS CAN BE KEPT IN MANY ACTIVITIES, INCLUDING THE FOLLOWING WHICH ARE DISCUSSED IN SOME DETAIL: ACTIVITY EXPENDITURE CONTROL WHICH COVERS COST CONTROLS IN PERSONNEL SERVICES, MAINTENANCE AND OPERATION, CONTRACTUAL SERVICES, AND CAPITAL OUTLAYS; TIME STUDIES WHICH YIELD COMPARISON RECORDS OF TIMES FOR USE IN JUDGING THE EFFICIENCY OF OPERATION OF EMPLOYEES AND PROCEDURES, PERSONNEL RECORDS, BOTH BACKGROUND AND ON-THE-JOB, RESEARCH AND DEVELOPMENT, JOB ANALYSIS AND WORK ORDERS, WHICH ENABLE THE DETERMINATION OF EFFICIENCY OF MAN-HOURS AND MATERIALS; MAINTENANCE RECORDS; PRODUCTION RECORDS; LABORATORY ANALYSIS RECORDS ON WATER QUALITY TESTS, ETC. ONE OF THE MOST IMPORTANT USES OF RECORDS LIES IN THE AREA OF BUDGET PREPARATION. (W71-03827).

00607. ECONOMIC ANALYSIS OF THE MEMBRANE WATER DESALTING PROCESSES.

CLARK, C.F.
OSW RESEARCH AND DEVELOPMENT PROGRESS REPORT NO. 638, DECEMBER 1970, 82 P.

THIS IS AN UPDATING OF AN EARLIER ECONOMIC ANALYSIS BY THE SAME INVESTIGATOR OF THE TWO PROCESSES, ELECTRODIALYSIS AND REVERSE OSMOSIS, WHICH EMPLOY SEMI-PERMEABLE MEMBRANES FOR THE PARTIAL DESALINATION AND DEMINERALIZATION OF BRACKFISH FEED WATERS. THE EARLIER WORK WAS PERFORMED IN 1967 AND REPORTED IN OSW R AND D REPORT NO. 495. AT PRESENT THE ELECTRODIALYSIS PROCESS HAS A SLIGHT COST ADVANTAGE OVER THE REVERSE OSMOSIS PROCESS FOR THE PARTIAL DEMINERALIZATION OF BRACKFISH FEEDWATERS IN THE 1000-2500 PPM TDS RANGE TO LEVELS WITHIN USPHS STANDARDS, BASED ON THE ECONOMIC GROUND RULES ASSUMED. ALTERNATIVELY, THE REVERSE OSMOSIS PROCESS IS THE MORE ADVANTAGEOUS WHEN APPLIED TO FEEDWATERS ABOVE THE 3000 PPM TDS LEVEL. A SHIFT IS FORECASTED IN THE BREAK-EVEN POINT IN FAVOR OF REVERSE OSMOSIS AT SOME FUTURE DATE BECAUSE OF THE RELATIVE AMOUNTS OF RESEARCH AND DEVELOPMENT EFFORT BEING APPLIED TO EACH PROCESS AND THE RELATIVE NEWNESS OF THE REVERSE OSMOSIS DEMINERALIZATION TECHNOLOGY. (GPO $0.75) (W71-10657).

00608. DEVELOPMENT OF A THIN-LIQUID-FILM MEMBRANE DEVICE FOR REVERSE OSMOSIS.

DAVIES, D.S.; BEMBERIS, I.
OFFICE OF SALINE WATER RESEARCH AND DEVELOPMENT PROGRESS REPORT NO 671, APRIL 1971, 96 P.

FIELD TESTING WAS CONDUCTED OF A THIN-LIQUID-FILM REVERSE OSMOSIS PILOT PLANT DESIGNED AND BUILT UNDER A PRIOR PROGRAM AND REPORTED IN OSW PROGRESS REPORT NO. 420. THE PILOT PLANT, OF A NOMINAL 1000 GPD CAPACITY, WAS OPERATED ON SEAWATER USING CELLULOSE ACETATE MEMBRANES. CHANNEL SPACINGS RANGING FROM 0.007 IN. TO 0.022 IN. WERE EMPLOYED AND THE FEASIBILITY OF OPERATING WITHIN THESE NARROW SPACINGS WAS SATISFACTORILY DEMONSTRATED. COST ESTIMATES WERE PREPARED TO INDICATE EFFECTS OF NARROW CHANNEL CONCEPTS ON LARGE REVERSE OSMOSIS PLANT ECONOMICS. IN GENERAL THE NARROW CHANNELS SHOWED ONLY MARGINAL ADVANTAGES OVER THE MORE CONVENTIONAL DESIGNS. (GPO $1.50) (W71-10661).

00609. ECONOMIC PRINCIPLES OF LIABILITY AND FINANCIAL RESPONSIBILITY FOR OIL POLLUTION.

HOROWITZ, S.
CENTER FOR NAVAL ANALYSIS, ARLINGTON, VA. PROFESSIONAL PAPER 56, MARCH, 1971, 25 P.

THE PAPER EXAMINES THE ECONOMIC ISSUES INVOLVED IN THE IMPOSITION OF LIABILITY FOR THE DAMAGES CAUSED BY DISASTERS IN GENERAL AND MAJOR OIL SPILLS IN PARTICULAR. THE CONCLUSIONS REACHED ARE THE FOLLOWING: UNLIMITED LIABILITY WITH ABSOLUTE FAULT IS TO BE PREFERRED TO LIMITED LIABILITY WHEN ONE TAKES THE WELFARE OF SOCIETY AS A WHOLE INTO ACCOUNT. IT MAY BE DESIRABLE TO LEVY FINES ON POLLUTERS ABOVE PAYMENT OF DAMAGES. OIL COMPANIES DO NOT HAVE A RIGHT TO CARRY ON POLLUTING ACTIVITIES; AND THE GOVERNMENT SHOULD MAKE CERTAIN

THAT FINANCIAL RESPONSIBILITY IS PROVIDED FOR. (AD-722 736) (W71-10671).

00610. MEASURES OF THE POTENTIAL ECONOMIC LOSS FROM OIL POLLUTION.

KUZMACK, R.A.
CENTER FOR NAVAL ANALYSES, ARLINGTON, VA. PROFESSIONAL PAPER 67, 15 MARCH 1971, 13 P.

THE SPECIFIC PROBLEM ADDRESSED IS THAT OF EMPIRICALLY ESTIMATING THE POTENTIAL IMPACT OF A LARGE SCALE OIL SPILL INTO THE PUBLIC WATERS ON THE ECONOMY OF A NEARBY COASTAL COMMUNITY. TAKING TWO AREAS AS CASE STUDIES, THE SENSITIVITY OF THEIR ECONOMIES TO EXOGENOUS CHANGES IN INCOME IS ESTIMATED USING AN ECONOMIC BASE MODEL. THE POTENTIAL LOSS IS THEN CALCULATED FROM THE AMOUNT OF INCOME DIRECTLY SUSCEPTIBLE TO OIL POLLUTION DAMAGES. (AD-722 378) (W71-10673).

00611. STORM AND COMBINED SEWER POLLUTION SOURCES AND ABATEMENT--ATLANTA, GEORGIA.

EPA WATER POLLUTION CONTROL RESEARCH SERIES, JANUARY 1971. 181 P.

RAINFALL FREQUENCY ANALYSIS AND SIMULATION TECHNIQUES WERE UTILIZED TO OBTAIN DESIGN CRITERIA FOR ALTERNATIVE POLLUTION ABATEMENT SCHEMES. HIGH FREQUENCY STORMS CAUSE THE WORST IMPACT AND MOST OF THE POLLUTION FROM COMBINED SEWER AREAS. OVERFLOWS AND BYPASSED FLOWS HAVE SEVERE IMPACT UPON THE SOUTH RIVER, DUE TO THEIR HIGH DEOXYGENATION RATES AND COLIFORM CONCENTRATIONS. ANNUAL BOD REDUCTION FROM COMBINED SEWER AREAS OF 57 PERCENT MAY BE ACHIEVED FOR A TOTAL ANNUAL COST OF $165,000, BY MODIFYING THE THREE REGULATORS AND TREATING 80 PERCENT OF THE OVERFLOWS, IN CONJUNCTION WITH STORAGE SUFFICIENT TO CONTAIN A TWO-WEEK STORM. ALTERNATE, LESS FAVORABLE SOLUTIONS INCLUDE STORAGE AND TREATMENT AT EXISTING TREATMENT PLANTS, AND STORAGE WITH RELEASE TO RECEIVING STREAMS AFTER CHLORINATION. SEPARATION OF COMBINED SEWERS WOULD ACHIEVE 60 PERCENT BOD REMOVAL FOR $3,030,000/YEAR. (PB-201 725) (W71-10749).

00612. ENGINEERING FEASIBILITY STUDY OF THE BISHOP SYSTEM FOR OPEN OCEAN OIL SPILLS.

COAST GUARD TECHNICAL REPORT 714031A/006, 25 NOV 1970, 89P.

AN ENGINEERING FEASIBILITY STUDY ON THE BISHOP SYSTEM INDICATED EFFECTIVENESS FOR OCEAN OPERATION AT LOW COST WITH CAPABILITY OF REMOVING ALL TYPES OF OIL SPILLS FROM OCEAN SURFACE. THE SYSTEM CONSISTS OF A BUOYANT APPARATUS, 21 FEET WIDE, PROPELLED AHEAD OF A SUPPORT VESSEL, WHICH CLOSELY TRACKS THE SEA SURFACE TO REMOVE THE OIL FILM. HYDRAULIC PUMPING CAPACITY IS 5000 GPM AND SYSTEM IS CAPABLE OF OPERATING AT 4 KNOT SPEED AND UP TO SEA STATE 4 AT REDUCED SPEED. CALCULATED SYSTEM EFFECTIVENESS IS 240 BARRELS PER HOUR FOR 1/16 INCHES THICK OIL FILM IN SMOOTH WATER AT 4.0 KNOTS. SYSTEM EFFICIENCY IS 5% OIL TO WATER PICKED UP FOR A 1/16 INCHES OIL FILM AND 100% FOR A 1 INCH OIL FILM. COST FACTORS FOR SKIMMING 1/16 INCHES OIL FILM IN SMOOTH WATER HAVE BEEN ESTIMATED AT $0.50/BBL. (AD-723 600) (W71-10766).

00613. PHOSPHATE RECOVERY FROM SECONDARY SEWAGE WASTE: THE ECONOMICS OF THE PROCESS.

HUMMEL, R.L.; SMITH, J.W.
WATER AND POLLUTION CONTROL, 108(2), 28-31, 1970.

A POTENTIAL INDUSTRIAL PROCESS--PHOSPHATE RECOVERY FROM SECONDARY SEWAGE WASTE--IS CONSIDERED ONLY FOR ITS DIRECT ECONOMIC RETURN. COSTS FOR SUCH A VENTURE ARE COMPRISED PRIMARILY OF OPERATING COSTS AND CAPITAL COSTS. OPERATING COSTS ARE SUBDIVIDED INTO CHEMICALS (WHICH ALSO PROVIDE THE SOLE SOURCE OF REVENUE IN THE MARKETABILITY OF EXTRACTED NH3 AND P205 IN THE FINAL PRODUCT), STEAM COSTS, AND LABOR COSTS. ESTIMATED DOLLAR EXPENDITURES ARE ASSIGNED TO THE OPERATING COSTS AND THE CAPITAL COSTS WHICH INCLUDE THE RELATIVELY UNCERTAIN COST OF THE RECIPROCATING FLOW ION EXCHANGE SYSTEM AND THE REMAINING CONVENTIONAL EQUIPMENT WHICH CAN BE COSTED QUITE ACCURATELY. THE ECONOMICS OF THE PROCESS ARE EXPRESSED IN TERMS OF THE NET RETURN ON INVESTMENT--OR THE RATIO OF REVENUE TO CAPITAL COSTS. A TABLE OF THE % RETURN FOR VARIOUS COMBINATIONS OF CASES FOR LABOR AND STEAM ARE LISTED WHICH YIELD RETURNS THAT RANGE BETWEEN 12% AND 30%. THUS THE ATTRACTIVENESS OF THE PROPOSAL DEPENDS UPON THE COMBINATION EMPLOYED AND ANY GOVERNMENT ASSISTANCE IN FINANCING AND/OR SUBSIDY IN OPERATION. (W71-10840).

00614. FURTHER THOUGHTS ON TRADE EFFLUENT CHARGES.

LAWSON, H. MCD.; FEARN, R.J.
WATER POLLUTION CONTROL, 69(4), 436-444, 1970.

MANY CITIES HAVE BEEN ATTEMPTING TO DETERMINE A FAIR TRADE EFFLUENT CHARGE WITH WHICH TO FINANCE ADDITIONAL TREATMENT FACILITIES WHICH MUST BE CONSTRUCTED TO HANDLE INDUSTRIAL WASTES. THE CITY OF NOTTINGHAM HAS DEVELOPED A SCHEDULE WHEREBY COSTS FOR EACH INDUSTRY ARE BASED ON: (1) ADDITIONAL SEWERAGE CAPACITY NEEDED FOR INDUSTRIAL FLOWS; (2) ADDITIONAL TREATMENT PLANT CAPACITY BASED ON BOTH ON FLOW AND ON OXYGEN DEMAND; AND (3) ADDITIONAL SLUDGE HANDLING AND DISPOSAL BASED PRIMARILY ON SUSPENDED SOLIDS TESTS. CHARGES WERE NOT LEVIED FOR TOXIC CONSTITUENTS AS LONG AS THEY NEITHER UPSET THE BIOLOGICAL PORTION OF THE SYSTEM NOR CAUSED THE TREATED EFFLUENT TO EXCEED STANDARDS SET BY THE TRENT RIVER AUTHORITY. (W71-10842).

00615. CLEAN WATER DAY PROMISES IMPROVED WASTEWATER TREATMENT.

STENMAN, A.
PUBLIC WORKS, 101(9), 64-85, 1970.

WITH THE AID OF A $357,000 GRANT FROM THE FEDERAL WATER QUALITY ADMINISTRATION FOR WASTE WATER SYSTEMS IMPROVEMENTS AND A BOND ISSUE VOTED BY THE CITY, MONEY WAS APPROPRIATED FOR THE NEEDED WORK. THE NEW DESIGN CALLS FOR RETAINING SOME OF THE OLD TREATMENT STRUCTURES. MODERNIZING THE WHOLE TREATMENT PLANT, AND ADDITIONS OF NEW EQUIPMENT TO ENLARGE THE AVERAGE FLOW CAPACITY OF THE PLANT FROM 1.1 MGD TO 2.2 MGD. PROVISIONS ARE TO BE MADE FOR EXPANSION OF THE FACILITIES TO HANDLE AN AVERAGE FLOW OF 4.4 MGD SOME TIME IN THE FUTURE. THE DESIGN BASIS CONSIDERED 130 GAL. PER CAPITA PER DAY FROM A POPULATION OF 17,000 IN COMPARISON TO PASO ROBLES'S PRESENT POPULATION

OF 8,100. THE SYSTEM CONSISTS OF A BAR SCREEN CHAMBER, PREAERATOR, PRIMARY SEDIMENTATION BASIN WITH PROVISION TO BE MADE FOR MECHANICAL SLUDGE AND SCUM REMOVAL, TRICKLING FILTER, CHLORINATOR, OXIDATION PONDS, PERCOLATION PONDS, AND SLUDGE DRYING BEDS. THE LOW BID OF $765,000 WAS WELL WITHIN THE ENGINEERS ESTIMATE OF $875,000. THE SUCCESS OF THE PROJECT WAS A RESULT OF THE COMMUNITY'S THOROUGH PREPARATION AND PAINS-TAKING EFFORT. (W71-10843).

00616. COSTS FOR EQUIVALENT UPSTREAM REDUCTION IN WASTE WATER DISCHARGES.

HEANEY, J.P.; CARTER, B.J.; PYATT, E.E.
WATER RESOURCES RESEARCH, 7(3), 458-462, 1971.

AN ANALYSIS OF THE TRADE-OFF BETWEEN MORE INTENSIVE UPSTREAM BOD REMOVAL AND BOD REMOVAL AT THE POINT OF DISCHARGE WAS PRESENTED FOR A REGIONAL RIVER SYSTEM. THE PURPOSE OF THE ANALYSIS WAS TO PROVIDE AN IMPROVED UNDERSTANDING OF THE INTERACTIONS AMONG THESE INTERRELATED DECISION MAKING UNITS. THE RELATIONSHIP BETWEEN THE MARGINAL COST OF WASTE TREATMENT AT THE POINT OF DISCHARGE AND THE MARGINAL COST OF MORE INTENSIVE WASTE TREATMENT UPSTREAM WAS EXPLORED. THE OPTIMAL SOLUTION WAS ANALYZED FROM THE POINT OF VIEW OF COMPARING THE EFFICACY OF INCREASED UPSTREAM TREATMENT. AS THE VALUE OF UPSTREAM WASTE TREATMENT TO THE INDIVIDUAL DISCHARGER DIMINISHED, THE FURTHER UPSTREAM ONE MOVED. A RELATIONSHIP FOR EVALUATING THIS TRADE-OFF WAS PRESENTED. POSSIBLE ALTERNATIVE SITUATIONS IN A REGIONAL SYSTEM WERE THEN ANALYZED. (W71-10860).

00617. MULTISTAGE MARGINAL COST MODEL OF INVESTMENT-PRICING DECISIONS: URBAN WATER SUPPLY TREATMENT FACILITIES.

RIORDAN, C.
WATER RESOURCES RESEARCH, 7(3), 463-478, 1971.

AN ATTEMPT WAS MADE TO APPLY A PREVIOUSLY DEVELOPED MODEL OF INVESTMENT-PRICING DECISIONS TO THE PARTICULAR PROBLEM OF CHOOSING THE TIMING AND SIZES OF ADDITIONS TO CAPACITY IN URBAN WATER SUPPLY SYSTEMS. ON THE BASIS OF EMPIRICAL DATA, TYPICAL BUT HYPOTHETICAL COST AND DEMAND CURVES FOR WATER SUPPLY WERE DEFINED AND INCORPORATED INTO THE MODEL. THE MODEL WAS THEN SOLVED UNDER VARYING ASSUMPTIONS WTIH REGARD TO RATE OF GROWTH IN DEMAND, THE LEVEL OF THE DISCOUNT RATE, AND THE LENGTH OF THE PLANNING HORIZON. THE RESULTS WERE COMPARED IN TERMS OF THEIR EFFICIENCY WITH RESULTS THAT COULD BE EXPECTED FROM CONVENTIONAL APPROACHES TO THE PROBLEM BY EMPLOYING CERTAIN ARBITRARILY ASSUMED SCHEMES OF AVERAGE COST PRICING COMBINED WITH RULES OF THUMB CRITERIA FOR CHOOSING THE TIMING OF CAPACITY INVESTMENT. THE CONCLUSIONS WERE THAT THE EMPIRICAL DATA NECESSARY TO EFFECTIVELY IMPLEMENT THE GENERAL MODEL IN THE WATER SUPPLY AREA WERE UNAVAILABLE AND THE RESULTS SUGGESTED THAT THE MULTISTAGE MARGINAL COST APPROACH TOWARD PLANNING AND OPERATING URBAN WATER SUPPLY SYSTEMS MIGHT BE 10-20% MORE EFFICIENT THAN TRADITIONAL AVERAGE COST APPROACHES. (W71-10861).

00618. ECONOMIC INCENTIVES FOR POLLUTION ABATEMENT: APPLYING THEORY TO PRACTICE.

REED, K.R.
ARIZONA LAW REVIEW, 12(3), 511-542, 1970.

THIS ARTICLE EXAMINES POLLUTION IN ECONOMIC TERMS, IDENTIFIES THE MAJOR CATEGORIES OF CONTROL, AND EXAMINES THE USE OF ECONOMIC INCENTIVES AS A MEANS OF ENCOURAGING ABATEMENT BY INDUSTRY. THE ECONOMIC VIEW OF POLLUTION SEES THE RESULTING DAMAGE TO THE ENVIRONMENT AS THE RESULT OF A BREAKDOWN IN THE MARKET ECONOMY. THE MAJOR PROBLEM IS TO FORCE THE POLLUTER TO BEAR THE ECONOMIC COSTS OF HIS ACTIONS DIRECTLY RATHER THAN SHIFTING THESE COSTS TO SOCIETY VIA POLLUTION. GOVERNMENTAL POLLUTION ABATEMENT EFFORTS ARE CLASSIFIED INTO THREE AREAS: (1) REGULATION OF THE POLLUTER THROUGH ESTABLISHMENT OF MINIMUM STANDARDS, (2) SUBSIDIES IN THE FORM OF TAX INCENTIVES BY BOTH THE FEDERAL AND STATE GOVERNMENTS, AND (3) WASTE DISCHARGE FEES. VARIOUS STATE TAX SYSTEMS ARE EXAMINED; THE RELIEF PROVISIONS ARE DEEMED TO REDUCE THE POLLUTER'S ECONOMIC COST OF ABATEMENT BUT FAIL TO SATISFY THE UNDERLYING NEED FOR AN ACTUAL INCENTIVE TO REDUCE POLLUTION. AFTER STUDYING A GERMAN SYSTEM AND A RECENT VERMONT ANTI-POLLUTION SYSTEM, THE MOST DESIRABLE FORM OF POLLUTION CONTROL IS DEEMED TO BE A SYSTEM OF EMISSION CHARGES WHICH CREATES INCENTIVE FOR ABATEMENT. (W71-10967).

00619. ALTERNATE POLICIES FOR RIVER BASIN WATER QUALITY MANAGEMENT.

DYSART, B.C. III.
PROCEEDINGS OF 14TH CONGRESS OF INTERNATIONAL ASSOCIATION FOR HYDRAULIC RESEARCH, HYDRAULIC RESEARCH AND ITS IMPACT ON THE ENVIRONMENT, VOL 5, P 419-1--419-6, 29 AUGUST -3 SEPTEMBER, 1971.

DUE TO THE RADICAL DIFFERENCES BETWEEN THE VARIOUS TREATMENT LEVELS INDICATED BY THE OPTIMAL POLICY AND A TRADITIONAL, FAMILIAR POLICY SUCH AS 85% TREATMENT FOR ALL WASTEWATER DISCHARGERS, DIFFICULTY IN IMPLEMENTING ECONOMICALLY OPTIMAL PLANS FOR REGIONAL WATER QUALITY MANAGEMENT WAS ENCOUNTERED. THE PRELIMINARY RESULTS OF A TWO-YEAR RESEARCH PROJECT PROVIDED INSIGHT INTO THE ECONOMICS OF ALTERNATE POLICIES OVER A WIDE RANGE OF DISSOLVED OXYGEN STANDARDS. FOR THE RIVER BASIN DISCUSSED, THE OPTIMAL POLICIES WERE FOUND BY USING DETERMINISTIC DYNAMIC PROGRAMMING. FOR AN INTERMEDIATE WATER QUALITY STANDARD OF 4 MG/L, THREE COMMONLY CONSIDERED ALTERNATE POLICIES RESULTED IN TOTAL COSTS TO THE SYSTEM WHICH WERE FROM 19 TO 83 PERCENT GREATER THAN THE OPTIMAL COST. BY ANALYZING THE LOCAL COSTS FOR THE INDIVIDUAL WASTE DISCHARGERS FOR THE ALTERNATE POLICIES AND STANDARDS, MUCH INFORMATION WAS OBTAINED TO ANTICIPATE THEIR RESPONSE TO, INTEREST IN, AND RESISTANCE TO VARIOUS APPROACHES TO RIVER BASIN WATER QUALITY MANAGEMENT. (W71-10985).

00620. DREDGING: PROBLEMS AND REMEDIES.

HANSEN, R.S.
LIMNOS, 4(1), 3-12, 1971.

THIS IS AN EXAMINATION OF THE ECOLOGICAL RAMIFICATIONS OF DREDGING AND DISPOSAL IN THE GREAT LAKES. WATER AND SEDIMENTS IN HARBORS, OPEN-LAKE DUMP-

ING AREAS, AND NEWLY CONSTRUCTED DISPOSAL SITES WERE SAMPLED AS WELL AS MATERIAL FROM SOURCES RELATED TO DREDGES, DIKES, BARRIERS, ETC., FOR ANALYSIS OF PHYSICAL AND CHEMICAL PROPERTIES POSSIBLY AFFECTING BIOTA AND WATER QUALITY. RELATION OF DREDGING TO POLLUTANTS, ESPECIALLY MERCURY, WAS CONSIDERED. SEVERAL PROCESSES AND COMBINATIONS OF PROCESSES FOR TREATMENT OF DREDGED MATERIAL WERE STUDIED. MOST 'TREATMENT' PROCESSES ARE NOT VERY EFFECTIVE FOR REMOVAL OF MANY POLLUTANTS, SUCH AS HEAVY METALS. DISPOSAL BEHIND ENCLOSED DIKES IS EXPENSIVE, BUT GENERALLY IS LESS COSTLY THAN OTHER MEANS OF HANDLING DREDGING EXCEPT LAKE DISPOSAL. FACTORS OF DESIGN, COMPOSITION, AND LOCATION OF DIKED AREAS VARY WIDELY IN DIFFERENT LOCALITIES (DISPOSITION OF DREDGED MATERIAL ON LAND OR IN MARSHY AREAS MAY HARM WILDLIFE AND THE ENVIRONMENT; FILLED-IN AREAS MIGHT BE USED BENEFICIALLY). 'BENEFITS' OF HALTING OPEN-LAKE DISPOSAL INCLUDE IMPROVEMENTS IN THE ECOLOGICAL ENVIRONMENT WHERE POLLUTED DREDGINGS ARE DEPOSITED, REMOVAL OF SOME UNDESIRABLE SEDIMENT MATERIAL WHICH COULD PENETRATE THE ECOSYSTEM, AND THE ADVANTAGE OF REDUCING TURBIDITY, ODOR, AND OIL SLICKS WHICH APPEAR DURING OPEN-LAKE DISPOSAL. (W71-11035.

00621. LIGHT CATALYZED CHLORINE OXIDATION FOR TREATMENT OF WASTEWATER.

MEINERS, A.F.
WATER POLLUTION CONTROL RESEARCH SERIES, SEPT 1970, 105 P.

A SMALL SCALE BATCH REACTOR AND A LARGER SCALE BATCH-RECYCLE REACTOR WERE USED TO DETERMINE OPTIMUM ILLUMINATION AND CHLORINE DOSE FOR OXIDATION OF THE SOLUBLE ORGANICS IN SECONDARY WASTE WATER EFFLUENT. PRIMARY VARIABLES STUDIED INCLUDED WAVELENGTH EFFECTS, INTENSITY-TIME RELATIONSHIPS, QUANTUM EFFICIENCIES, CHLORINE CONCENTRATION, AND THE EFFECT OF DISSOLVED OXYGEN. FOR OPTIMAL OPERATION, LIGHT OF LOW INTENSITY AND LESS THAN 300 WAVELENGTH, AND CHLORINE OF LESS THAN 5 MG/L SHOULD BE USED. PROCESS COST ESTIMATES WERE MADE FOR A 10 MGD PLANT. INITIAL INVESTMENTS WERE ESTIMATED AT $990,000. FIXED CHARGES WERE ESTIMATED AT 3.42 CENTS/1000 GAL, AND OPERATING COSTS WERE FIGURED AS: (1) LABOR 2.79 CENTS/1000 GAL; (2) LAMP REPLACEMENT $1.70/1000 GAL, AND (3) CHLORINE $2.09/1000 GAL. WITH AN ADDITIONAL $1.77/1000 GAL FOR MISCELLANEOUS EXPENSES. TOTAL OPERATING COSTS WERE $8.35/1000 GAL. MAJOR ASSUMPTIONS USED FOR COST ESTIMATION WERE: (1) 15 MG/l COD DECREASE REQUIRED; (2) 1.30 QUANTUM EFFICIENCY; (3) A STOICHIOMETRIC AMOUNT OF CHLORINE, AND (4) CONTINUOUS ADDITION OF CAUSTIC. ESTIMATED OVERALL COSTS WERE 11.77 CENTS/1000 GALS. FURTHER COST DECREASES MAY OCCUR AS THE RESULT OF DEVELOPMENTS IN: (1) MORE INTENSE AND/OR MORE EFFICIENT LIGHTING, (2) UTILIZATION OF HIGHER QUANTUM EFFICIENCIES DUE TO IMPROVED OPERATING CONDITIONS, AND (3) WAYS OF REDUCING THE DOSAGES OF CHLORINE AND CAUSTIC REQUIRED (PB-202 230) (W71-11364).

00622. USE OF FUNGI IMPERFECTI IN WASTE CONTROL.

CHURCH, B.D.; NASH, H.A.
WATER POLLUTION CONTROL RESEARCH SERIES, JUL 1970. 84 P.

TRICHODERMA VIRIDE, GLIOCLADIUM DELIQUESCENS AND EITHER ASPERGILLUS ORZAE OR G. DELIQUES CENS WERE SELECTED FROM A FIELD INCLUDING 45 SPECIES OF 21 GENERA OF THE FUNGI IMPERFECTI AS OPTIMAL ORGANISMS FOR THE DEGRADATION OF CORN, SOY, AND SO2 CONTAINING SOY WHEYS RESPECTIVELY. CRITERIA FOR SELECTION INCLUDED RAPID GROWTH, EASE OF REMOVAL FROM SOLUTION BY COARSE FILTRATION, AND BOD REDUCTION CAPABILITIES. OPTIMAL GROWTH FOR ALL THREE WASTES INCLUDED: (1) PH BETWEEN 3.2 AND 3.5; AND (2) A TEMPERATURE OF 30 DEG C. ADDITION OF BOTH NITROGEN AND PHOSPHORUS WAS NECESSARY FOR THE CORN WASTES, AND PH IN ALL WASTES WAS ADJUSTED WITH SULFURIC ACID. INITIAL STUDIES WERE DONE IN 125 ML FLASKS CONTAINING NON-STERILE CORN OR SOY WASTES. AFTER SELECTION OF OPTIMAL ORGANISMS FOR EACH WASTE, FINAL STUDIES UTILIZED REACTORS OF 20 LITERS IN VOLUME. 24 HOURS INCUBATION TIME WAS SUFFICIENT TO REDUCE CORN WASTE BOD FROM 1600 MG/L TO 25 MG/L, WHILE THE REDUCTION OF SOY WASTE BOD FROM 6200 MG/L TO 125 MG/L REQUIRED 36 HOURS. OVERALL MYCELIAL YIELDS WERE APPROXIMATELY 50 TO 60 G OF DRY MYCELIUM PER 100 G COD UTILIZED. THE PROTEIN CONTENT OF CORN WASTE MYCELIUM WAS 45% AND THE PALATABILITY TO WEANLING RATS WAS 90%. NO TOXICITY WAS EVIDENT AFTER THREE WEEKS, AND THE GROWTH RESPONSE WAS SIMILAR TO THAT OBTAINED WITH A STANDARD DIET. ECONOMIC ANALYSIS REVEALED THAT SOY WASTE MYCELIUM WOULD PROVIDE A PROFIT MARGIN, WHILE TREATMENT OF CORN WASTES WOULD CAUSE A SLIGHT LOSS. (PB-202 231) (W71-11365).

00623. GELLING CRUDE OILS TO REDUCE MARINE POLLUTION FROM TANKER OIL SPILLS.

POLLUTION CONTROL RESEARCH SERIES, JANUARY 1971, 137 P.

ALL AVAILABLE INFORMATION CONCERNING THE GELLING OR SOLIDIFYING OF PETROLEUM PRODUCTS WAS GATHERED TO PROVIDE A STARTING POINT FOR TESTING OF MATERIALS INTENDED TO GEL OILS FOR THE REDUCTION OF OIL LOSS AND RESULTANT MARINE POLLUTION. LABORATORY EVALUATIONS OF BOTH FOREIGN AND DOMESTIC OILS USING A WIDE RANGE OF GELLING AGENTS WERE PERFORMED. MEASUREMENTS OF GEL STRENGTH BY THE ROTARY VISCOSIMETER, THE PENETROMETER, THE RHEOGRAM AND OTHERS WERE COMPARED TO DETERMINE THEIR VALIDITY AND ACCURACY. FOR THE PURPOSES OF COMPARISON AND BECAUSE OF THE EASE OF OPERATION, THE PENETROMETER WAS USED FOR THIS WORK. AN AMINE/ISOCYANATE COMBINATION WAS FOUND TO HAVE THE BEST GELLING PROPERTIES OF THE COMPOUNDS TESTED. HOWEVER, THE GEL PRODUCED STILL DID NOT COMPLETELY FULFILL THE NEEDS SINCE OIL COULD STILL ESCAPE FROM A RUPTURED TANKER. HOWEVER, THE RATE AT WHICH THE OIL ESCAPED WOULD BE CONSIDERABLY LESS, AND THE GELLED OIL WOULD BE IN THE FORM OF CLUMPS AND WOULD NOT FORM A SLICK. TWO SYSTEMS, A HELICOPTER-BORNE SYSTEM SERVING A GEOGRAPHICAL AREA AND A SHIP-BORNE SYSTEM SERVING EACH INDIVIDUAL SHIP, WERE EVALUATED ON A BASIS OF ADDITIONAL TOTAL COST PER TON-MILE. AN AVERAGE INCREASE OF . 051 MILS PER TON MILE FOR THE SHIP-BORNE SYSTEM WAS REPORTED, WHILE THE AIR-BORNE SYSTEM COST ONLY . 002 MILS/TON MILE. CLEAN-UP COSTS HAVE BEEN ESTIMATED AT $150 TO $200/BBL, SO AVERAGE DELIVERY TIME IS A CRITICAL FACTOR IN OIL LOST. (PB-202 239) (W71-11374).

00624. PHOTOSYNTHETIC RECLAMATION OF AGRICULTURAL SOLID AND LIQUID WASTES--SECOND PROGRESS REPORT.

DUGAN, G.L.; GOLUEKE, C.G.; OSWALD, W.J.; RIXFORD, C.E.

CALIFORNIA UNIVERSITY, SANITARY ENGINEERING RESEARCH LABORATORY, REPORT NO. 70-1, 165 P.

A 36-WEEK STUDY WAS INITIATED TO PROVIDE INFORMATION ON THE ECONOMICS OF TREATING ANIMAL WASTES. CHICKENS WERE CHOSEN, MAINLY FOR CONVENIENCE SAKE, AS THE ED IN CAGES. THE TREATMENT SYSTEM USED CONSISTED OF INCLINED TROUGHS UNDER THE CAGES WHICH WERE FLUSHED WITH WATER FROM A FLUSHING BUCKET, GRIT REMOVAL, SEDIMENTATION, AN OXIDATION LAGOON FOR THE SEDIMENTATION TANK SUPERNATANT, AND AN ANAEROBIC DIGESTER FOR THE SOLIDS. THE SYSTEMS APPROACH WAS USED, AND SYSTEM BALANCES WERE PERFORMED FOR TOTAL SOLIDS, VOLATILE SOLIDS, TOTAL UNOXIDIZED NITROGEN AND ENERGY FOR THE CHICKENS, SEDIMENTATION TANK, DIGESTER, AND ALGAE. ALL BALANCES WERE PERFORMED FROM WEEK 5 THROUGH WEEK 36 EXCEPT FOR THE DIGESTER, WHERE OPERATION WAS TERMINATED AT WEEK 24 AND THE SOLIDS DEWATERED, DRIED, AND STUDIED FOR POSSIBLE FURTHER REUSE. AN ECONOMIC ANALYSIS OF AN INTEGRATED SYSTEM OF 100,000 LAYING HENS REVEALED A COST OF APPROXIMATELY 2 CENTS/DOZEN EGGS FOR A SYSTEM BASED ON THE ONE TESTED. HOWEVER, CONSIDERATION OF AN EXTREMELY CONSERVATIVE ALGAE HARVESTING RATE OF 12 TONS/ACRE/YEAR AT A PRICE OF 5 CENTS/LB (DRY WEIGHT) DROPPED THE OVERALL WASTE HANDLING OUTLAY TO APPROXIMATELY 1 CENT/DOZEN. (W71-11375).

00625. MEAT PACKING WASTES RESPOND TO MANY TREATMENT METHODS.

ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 5(7), 590-592, 1971.

137 MILLION COWS, PIGS, AND LAMBS WERE SLAUGHTERED IN 1970. WASTE PRODUCTS FROM A MEDIUM SIZED PACKING PLANT WERE SHOWN TO HAVE A POPULATION EQUIVALENT OF 100,000 PEOPLE. A GALLON OF BLOOD ALONE, WITH A BOD IN EXCESS OF 150,000 PPM, HAS THE SAME OXYGEN DEMAND AS THE DAILY WASTES FROM 7 TO 8 PEOPLE. HOWEVER, MUCH OF THE BLOOD, SCRAP, AND GREASE PRODUCED IS OF SUFFICIENT ECONOMIC VALUE TO JUSTIFY RECOVERY. NEARLY ALL PACKING PLANTS HAVE A CATCH BASIN OR HOLDING TANK PROVIDING AT LEAST A 20 MIN. DETENTION TIME FOR RECOVERY OF SCRAPS AND GREASE. FURTHER TREATMENT METHODS HAVE BEEN WELL DOCUMENTED, AND INCLUDE LAGOON SYSTEMS, AIR FLOTATION, ACTIVATED SLUDGE, TRICKLING FILTERS, ROTATING BIOLOGICAL CONTACTORS, OXIDATION DITCHES, AND ANAEROBIC CONTACTORS FOLLOWED BY POLISHING LAGOONS. SEVERAL CONSTRUCTION OPTIONS ARE ALSO AVAILABLE, DEPENDING UPON THE SITUATION: (1) PLANTS MAY CONSTRUCT THEIR OWN, IN-HOUSE TREATMENT FACILITIES; (2) PLANT EFFLUENT MAY BE DISCHARGED DIRECTLY TO A MUNICIPAL SEWER IN CASES WHERE THE MUNICIPAL PLANT HAS SUFFICIENT CAPACITY; AND (3) THE MUNICIPALITY MAY BUILD A NEW TREATMENT PLANT FOR THE SLAUGHTERHOUSE WASTES, OPERATE IT, AND CHARGE THE SLAUGHTERHOUSE FOR THE SERVICES. AN EXAMPLE OF THE THIRD ALTERNATIVE IS PRESENTED. (W71-11387.

00626. HANDLING DYE WASTES IN A MUNICIPAL PLANT.

WILLIAMSON, R.

PUBLIC WORKS, 102(1), 58-59, 1970.

THE WATER POLLUTION CONTROL PLANT AT TARBORO, NORTH CAROLINA, WAS DESIGNED TO HANDLE 1.3 MGD OF MUNICIPAL WASTES, EMPLOYING SEDIMENTATION, BIOCHEMICAL OXIDATION BY TRICKLING FILTER, AND CHLORINATION. COMMISSIONED IN 1960, THE PLANT FUNCTIONED WELL EVEN WITHOUT THE CHLORINE FACILITIES UNTIL THE AREA BECAME A CENTER FOR FABRIC DYEING. BY LATE 1969, THE INDUSTRY CONTRIBUTED 295,000 GPD OF DYE WASTE, OR 40% OF THE TOTAL INFLUENT. REDUCTIONS OF BOTH BOD AND SUSPENDED SOLIDS HAD DROPPED FROM THE 80% RANGE TO THE 60% RANGE. IN FEBRUARY OF 1970, CHLORINATION OF THE EFFLUENT AT 20 MG/L WAS INSTITUTED AS A CORRECTIVE MEASURE. BOD REDUCTIONS OBTAINED RANGED FROM 85 TO 95%. IN JUNE 1970, FLOCCULATION TESTS WERE BEGUN, USING ALUM AS THE FLOCCULANT. BOD REDUCTION THROUGH THE PLANT WAS 90% BEFORE CHLORINATION, AND 97% AFTER CHLORINATION. SUSPENDED SOLIDS REMOVALS AVERAGED IN EXCESS OF 97%. ONCE THE FACT THAT A HIGH DEGREE OF TREATMENT COULD BE ACHIEVED WAS ESTABLISHED, A COST ANALYSIS WAS MADE. COSTS FOR ALUM FLOCCULATION PLUS CHLORINATION RANGED FROM $50-75 PER DAY. CHLORINATION ALONE AMOUNTED TO $10 TO $15 PER DAY BUT DID NOT REDUCE SUSPENDED SOLIDS. ALUM FLOCCULATION, ON THE OTHER HAND, DID PROVIDE ACCEPTABLE REMOVALS BOTH OF BOD AND SUSPENDED SOLIDS AT A COST OF $35 TO $60 PER DAY WHEN USED ALONE. FURTHER COST COMPARISONS USING POLYELECTROLYTE COAGULANT AIDS ARE CONTINUING. (W71-11388).

00627. FILTER PRESS COSTS VERSUS LAND DEMAND.

EDMONDSON, B.R.

SURVEYOR, 134(4075), 1970.

SLUDGE DRYING IS A LOW COST MEANS OF SEWAGE TREATMENT WHICH HAS BEEN VERY POPULAR ESPECIALLY SINCE IT ONLY REQUIRES ENOUGH LAND TO ALLOW FOR DRYING AND LAGOONS TO RECEIVE WHAT THE BEDS CANNOT HANDLE. WALSALL CORPORATION AND LATER THE UPPER THAMES DRAINAGE AUTHORITY, WHICH ASSUMED THE CORPORATION'S RESPONSIBILITIES FOR SEWERAGE, WAS USING THE SLUDGE DRYING PROCESS WHEN DIFFICULTIES AROSE. THE SLUDGE DRYING AREA WAS FULLY LOADED, OTHER SITES WERE HARD TO FIND, LAND COSTS HAD RISEN STEEPLY, AND A MOTORWAY WAS ROUTED THROUGH THE AREA IN WHICH THE LAGOONS WHICH HELD THE EXCESS SLUDGE WERE SITUATED. IN ADDITION, SLUDGE ACCUMULATION DURING THE WINTER MONTHS, ANNUAL INCREASES IN STOCKPILES OF DRIED SLUDGE, DANGER OF INCREASES IN POLLUTION DUE TO SMELL NUISANCE, AND FIRE HAZARDS WERE PROBLEMS. IN 1969, THE FILTER PRESS METHOD OF DRYING WAS INSTALLED. THE MECHANICAL DRYING METHOD WAS MORE EXPENSIVE THAN NATURAL DRYING, BUT IT ALSO HAD ADVANTAGES. TESTS WERE MADE TO DISCOVER THE MOST PRACTICAL PRESS SIZE TO USE IN THE NEW SYSTEM, AND IT WAS SHOWN THAT A SMALL 51 SQ IN PLATE WAS IN GENERAL BETTER THAN THAT OF A PRESS WITH A LARGER PLATE. THE CAKE THUS PRODUCED HAS A MOISTURE CONTENT SOME 4-5% LOWER THAN THAT PRODUCED BY THE OTHER PRESS. THE COST PER TON OF DRIED SOLIDS FROM THE DRYING BEDS WAS 57-7 SHILLINGS PER TON, WHILE THE PRESS PLANT COSTS WERE 149-9 SHILLINGS PER TON OF DRY SOLIDS. ALTHOUGH THE FILTER PRESS METHOD MAY SEEM MORE EXPENSIVE, THE EXPENSES SEEM NEGLIGIBLE WHEN COM-

PARED TO THE REDUCED NEED FOR AIR POLLUTION CONTROL OF SMELL AND SMOKE, IMPROVEMENTS OF THE AESTHETICS OF THE AREA AND REDUCTION OF THE DEMAND FOR LAND. (W71-11391).

00628. GROWN-UP COMPANY TOWN COPES WITH POLLUTION PROBLEMS.

MCLANE, F.C.
PUBLIC WORKS, 101(9), 99-100, 1970.

THE PEOPLE OF WARE SHOALS, SOUTH CAROLINA, WERE FACED WITH THE DOUBLE TASK OF DEALING WITH POLLUTION AND ORGANIZING A NEW CITY GOVERNMENT IN 1967, WHEN IT WAS INCORPORATED. PRELIMINARY ENGINEERING PLANS WERE MADE AND A BOND ISSUE OF $800,000 WAS VOTED. IN 1968, RIEGEL TEXTILE CORPORATION, THE COMPANY WHICH ORIGINALLY ESTABLISHED THE TOWN AND HAD PROVIDED MANY SERVICES BEFORE INCORPORATION, OFFERED THE IDEA OF BUILDING A JOINT INDUSTRIAL/DOMESTIC LAGOON FOR THE DISPOSAL OF DOMESTIC SEWAGE AND INDUSTRIAL WASTES. WARE SHOALS WILL BUILD, OWN, AND OPERATE THE FACILITY, WHILE RIEGEL HAS CONTRACTED TO PAY APPROXIMATELY 90% OF THE CONSTRUCTION AND OPERATING COSTS. THIS PROPOSAL WAS ADVANTAGEOUS TO THE CITY IN MANY WAYS: (1) THE SITE OFFERED WAS THE ONLY PRACTICAL ONE FOR THE LOCATION OF THE LARGEST LAGOON IN THE PROPOSED SYSTEM, THEREBY SAVING A SWITCH TO ANOTHER TYPE OF SYSTEM, (2) THE TOWN SAVED $60,000 IN CONSTRUCTION COSTS. RIEGEL ALSO BENEFITED IN THAT IT WOULD SAVE $300,000 IN COSTS DUE THE TOWN'S BEING ABLE TO OBTAIN FEDERAL WATER POLLUTION CONTROL GRANTS. ALTHOUGH THE TOWN HAD A WATER SYSTEM OF SORTS, IT WAS VERY INADEQUATE DUE TO AGE, CORROSION, AND SMALL PIPES. THERE WAS NO TREATMENT OF DOMESTIC SEWAGE AT ALL, AND INDUSTRIAL WASTE WAS EMPTIED INTO THE SALUDA RIVER AFTER ONLY PARTIAL TREATMENT. PLANS CALL FOR EXTENSION OF WATER LINES, REPAIR AND REPLACEMENT OF OTHER LINES, EXTENSION OF THE SEWER SYSTEM TO ALMOST ALL AREAS OF TOWN, AND CONSTRUCTION OF TWO LAGOONS ON ONE SIDE OF TOWN AND THE LARGE COMBINED LAGOON ON THE RIVER. (W71-11394).

00629. DESIGN AND OPERATING EXPERIENCES USING DIFFUSED AERATION FOR SLUDGE DIGESTION.

RITTER, L.E.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 42(10), 1782-1791, 1970.

THREE SEWAGE TREATMENT PLANTS, HAVING MODIFICATIONS OF THE ACTIVATED SLUDGE PROCESS AND AEROBIC SLUDGE DIGESTION WITH DIFFUSED AERATION, WERE STUDIED TO DETERMINE THE ACTUAL PERFORMANCE AND COST FIGURES OF SUCH SYSTEMS. TWO OF THE SYSTEMS RECEIVED LITTLE OR NO INDUSTRIAL WASTE, WHILE INDUSTRIAL WASTES CONTRIBUTED NEARLY 70% OF THE INFLUENT TO THE THIRD PLANT. THE PLANTS' POPULATION EQUIVALENTS SERVED RANGED FROM 7,500 FOR THE LARGEST TO 3,650 FOR THE SMALLEST. ALL THREE PLANTS WERE LOADED AT OR NEAR THEIR DESIGN CAPACITY, AND ALL PRODUCED A STABLE, READILY DEWATERABLE SLUDGE, USEFUL FOR SOIL CONDITIONING AND FERTILIZING. AEROBIC DIGESTION, ALTHOUGH NOT PRODUCING AS GREAT A REDUCTION OF VOLATILE SOLIDS AS DID ANAEROBIC PROCESSES, WAS NEITHER INHIBITED AS EASILY NOR WAS IT PLAGUED BY FOUL ODOR PROBLEMS. PRESENT DESIGN CRITERIA OF 3.0 TO 5.0 CU FT/POPULATION EQUIVALENT OF DIGESTER VOLUME AND 1.0 SQ FT/POPULATION EQUIVALENT OF DRYING BED AREA WERE SHOWN TO BE SUFFICIENT WITHIN THE LIMITATIONS OF PREVAILING WEATHER CONDITIONS. AERATION RATES IN ACTUAL PRACTICE HAVE BEEN FOUND TO VARY BETWEEN 25 AND 30 CFM/1000 CU FT, SLIGHTLY ABOVE THE RECOMMENDED 20 CFM/1000 CU FT. AVERAGE POWER COSTS WERE COMPUTED AND FOUND TO BE $2.18/YR/LB OF BOD RECEIVED/DAY, OR $. 37/YR/POPULATION. BELOW POPULATION OF 8,000, OPERATING COSTS FOR AEROBIC DIGESTION WERE LESS. AT 8,000 OR ABOVE, THE SITUATION REVERSED. (W71-11395).

00630. THE FEASIBILITY OF IRRIGATING SOFTWOOD AND HARDWOOD FOR DISPOAL OF PAPERMILL EFFLUENT.

WILSON, C.W.
PAPER NO 71 - 245, 1971 ANNUAL MEETING, AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS, WASHINGTON STATE UNIVERSITY, PULLMAN, WASH., JUNE 27-30, 1971. 31 P.

THE FEASIBILITY OF IRRIGATING TREES WITH KRAFT PAPERMILL EFFLUENT TO REDUCE STREAM POLLUTION DURING THE LOW FLOW PERIOD OF THE SUMMER MONTHS, AND THE POSSIBLE ADVERSE EFFECTS ON THE SOIL WERE DETERMINED. FOR SOFTWOODS THE POSSIBILITY OF DISPOSING OF PAPERMILL EFFLUENT BY IRRIGATION SEEMS PROMISING AND WOULD REDUCE POLLUTION OF LOCAL STREAMS. COST OF THE SPRINKLER SYSTEM STUDIED WAS $137.00 PER ACRE PER YEAR. BLACK WATER AND WHITE WATER COULD PROBABLY BE USED IN THE RATIO THAT THEY ARE DISCHARGED (80% BLACK WATER AND 20% WHITE WATER). WITH THE BOTTOM LAND HARDWOODS IT WAS DETERMINED THAT 19.3 INCHES OF PAPERMILL EFFLUENT COULD BE APPLIED DURING THE SUMMER GROWING SEASON. HOWEVER, IT WAS RECOMMENDED THAT A MIXTURE OF 90% WHITE WATER AND 10% BLACK WATER BE USED FOR IRRIGATION. A FLOOD IRRIGATION SYSTEM WOULD COST $7.43 PER YEAR. THE AVERAGE INCREASE RELATIVE TO HARDWOOD GROWTH WAS FOUND TO BE APPROXIMATELY 6 PERCENT. (PB-202 561) (W71-11644).

00631. ECOLOGY AND RESOURCE ECONOMICS: AN INTEGRATION AND APPLICATION OF THEORY TO ENVIRONMENTAL DILEMMAS.

CHAPMAN, D.; O'NEILL, R.V.
ORNL-4641 DECEMBER 1970. 36 P.

A HIERARCHICAL CLASSIFICATION SCHEME HAS BEEN USED TO DEVELOP THE CONCEPT OF A FUNCTIONAL SYSTEM LINKING RELEVANT KNOWLEDGE IN BOTH ECONOMICS AND ECOLOGY. AS AN EXAMPLE, POWER PRODUCTION IS DESCRIBED WITHIN A MATRIX CONSISTING OF (A) FIVE ENERGY SOURCES, (B) SIX STAGES OF PRODUCTION AND DISTRIBUTION, AND (C) THEIR INTERACTIONS WITH ECOSYSTEMS AND NONMARKET COSTS. NONMARKET COSTS ARE THE BASIS FOR ANTICIPATING DIVERGENCE BETWEEN SOCIAL AND MARKET EQUILIBRIA: EXAMPLES ARE BROWNOUTS, POWER PLANT SITING CONTROVERSIES, AND VARIOUS FORMS OF POLLUTION. THE THEORY OF EXPECTED UTILITY MAXIMIZATION IS USED HEREIN TO SUGGEST THAT UNCERTAINTY PERTAINING TO POWER NEEDS INCREASES THE EXPECTED SOCIAL COST OF NEW CAPACITY. WE CONCLUDE WITH THE SUGGESTION THAT THIS RESEARCH MAY SERVE AS AN INTRODUCTION TO A COMPREHENSIVE ANALYSIS OF POWER PRODUCTION AND PUBLIC POLICY. (ORNL-4641) (W71-11673).

00632. EVALUATION OF A NEW ACID MINE DRAINAGE TREATMENT PROCESS.

WATER POLLUTION CONTROL RESEARCH SERIES, FEBRUARY 1971. 155 P.

A TWO-STAGE COMBUSTION PROCESS HAS BEEN DEVELOPED TO UTILIZE COAL REFUSE IN THE RENOVATION OF ACID MINE WATER TO POTABLE WATER. THE COAL REFUSE IS DISSOLVED IN MOLTEN IRON SO THAT COMBUSTION TAKES PLACE ONLY AT THE SURFACE. CARBON MONOXIDE FORMED THERE IS ALSO BURNED. ENERGY SUPPLIED BY THE COMBUSTION MAY BE USED EITHER FOR DISTILLATION OR REVERSE OSMOSIS UNITS. ALTHOUGH THE COAL REFUSE IS USUALLY HIGH IN SULFUR CONTENT, THE TWO STAGES OF THE COMBUSTION PROCESS INSURE THAT THE SULFUR DOES NOT ESCAPE TO POLLUTE THE AIR, SINCE THE REFUSE SULFUR IS EVENTUALLY TRAPPED IN THE SLAG AND RECOVERED FOR SALE. LABORATORY EVALUATIONS WERE MADE ON THE VARIOUS COMPONENTS OF THE PROCESSES, AND FROM THESE DETERMINATIONS A COST ESTIMATE WAS FORMULATED. DEPENDING ON THE COMPOSITION OF THE ACID MINE WATER (COAL REFUSE) USED AND ON THE SULFUR SELLING PRICE ($20 TO $30/TON), THE BREAKEVEN PRICE FOR WATER FOR A 5 MGD PLANT VARIES FROM $ .42 TO $ .16/1000 GAL WHEN A 14% CAPITAL INTEREST CHARGE IS USED. IT IS RECOMMENDED THAT THE KINETICS OF SLAG DESULFURIZATION, CALCIUM SULFATE TO CALCIUM SULFIDE REDUCTION, AND CARBON SOLUBILITY RATE BE MORE THOROUGHLY INVESTIGATED AND ELUCIDATED IN THE LABORATORY, ALONG WITH AN EVALUATION OF THE REFRACTORIES USED. AFTER THESE INVESTIGATIONS, A REVISION IN THE COST ESTIMATES SHOULD BE POSSIBLE. (PB-202 571) (W71-11795).

00633. SECOND ANNUAL REPORT - OPERATION OF THE MULTI-STAGE FLASH DISTILLATION PLANT, SAN DIEGO, CALIFORNIA.

OFFICE OF SALINE WATER RESEARCH AND DEVELOPMENT PROGRESS REPORT NO. 645, MAR 1971, 296 P.

THE GENERAL DISCUSSION CONCERNS THE MANAGEMENT, OPERATION, MAINTENANCE, PHYSICAL PLANT, AND INFORMATION GAINED IN THE OVERALL PROGRAM OF ADVANCING THE STATE OF THE ART OF DESALTING TECHNOLOGY. THE PLANT IS A 2,500,000 GALLON PER DAY FULL SIZE MODULE OF A 50,000,000 GALLON PER DAY MULTISTAGE FLASH SEA WATER DESALINATION PLANT. THE MODULE IS OPERATED IN CONJUNCTION WITH A UTILITY ELECTRIC POWER PLANT. THE PLANT IS DESIGNED TO PROVIDE MEANINGFUL DATA CONCERNING THE DESIGN AND OPERATION OF LARGE DESALINATION PLANTS INCLUDING SUCH ITEMS AS HEAT TRANSFER, EQUIPMENT AND STRUCTURAL DESIGN, MATERIALS COST OF PROVIDING FRESH WATER, PROCESS ENGINEERING, OPERATION OF MULTIPURPOSE PLANTS, AND EQUIPMENT PERFORMANCE. (GPO $2.50) (W71-11869).

00634. OPTIMAL PLANS FOR THE CAPACITY EXPANSION OF A MUNICIPAL WATER TREATMENT-DISTRIBUTION SYSTEM.

HINOMOTO, H.
ILLINOIS WATER RESOURCES CENTER, URBANA, RESEARCH REPORT NO. 39, 45 P.

THE ECONOMIES OF SCALE, WHICH LOWER THE COST PER UNIT VOLUME WITH INCREASING FACILITY SIZE, HAVE NECESSITATED MUCH PLANNING AND CONSTRUCTION WITH FUTURE NEEDS IN MIND, REQUIRING THE FORMULATION OF A CAPACITY EXPANSION MODEL. THE MODEL ASSUMES SEVERAL CONDITIONS, NAMELY: (1) THE SCALE EFFECTS IN BOTH CAPITAL AND OPERATING COSTS OF A TREATMENT PLANT OR DISTRIBUTION RESERVOIR ARE REPRESENTED BY CONCAVE FUNCTIONS OF CAPACITY IN EXPONENTIAL FORM; (2) DEMAND CONTINUOUSLY INCREASES OVER A FINITE PERIOD BEYOND WHICH IT STAYS AT THE MAXIMUM LEVEL ATTAINED AT THE END OF THE PERIOD, AND (3) FACILITIES EXISTING AT THE OUTSET AND THOSE INSTALLED DURING THE PLANNING PERIOD ARE PLACED BY PERMANENT CHAINS OF FACILITIES IDENTICAL WITH THEM. MINIMIZATION OF TOTAL COST OF INVESTMENT AND OPERATION AND A SET OF CONSTRAINTS ON THE TREATMENT AND STORAGE CAPACITIES ARE THE BASIS FOR THE MODEL FORMULATION. THE DEMANDS TO BE SATISFIED INCLUDE THE EXPECTED DAILY MAXIMUM DEMAND, EQUALIZATION DURING THE DAILY PEAK PERIOD, AND FIRE FIGHTING. AS AN EXAMPLE, THE MODEL WAS APPLIED IN THE CHAMPAIGN-URBANA AREA IN ILLINOIS. THE PERIOD 1970 TO 1985 WAS USED FOR FORECASTING DEMANDS AND PLANNING NEW INSTALLATIONS, AND AN INTERPRETATION OF THE RESULTS IS PRESENTED. (W71-12040).

00635. OZONATION, NEXT STOP TO WATER PURIFICATION.

BENDER, R.J.
POWER, 114(8), 58-60, 1970.

BECAUSE OZONE IS PROVING TO BE A VERY GOOD OXIDIZING AGENT, IT IS VERY USEFUL IN PURIFICATION OF WATER BY OXIDATION. IT IS USED MOSTLY IN PREPARATION OF MUNICIPAL POTABLE WATER IN INCREASING NUMBERS OF CITIES AND PURIFYING DRINKING WATER, MAINLY IN EUROPE. ALTHOUGH CHLORINATION HAS DONE A GOOD, ECONOMICAL JOB IN INITIALLY REDUCING BACTERIAL COUNT, LABORATORY TESTS HAVE SHOWN THAT A SUPPLEMENTARY TREATMENT WAS NEEDED. THE PURIFICATION PROCESS CALLS FOR CHLORINATION AND THOROUGH FILTRATION BEFORE OZONATION. OZONATION OF DRINKING WATER OFFERS SEVERAL ADVANTAGES OVER SIMPLE CHLORINATION: (1) BACTERIA AND VIRUSES ARE KILLED COMPLETELY IN SHORTER CONTACT TIME WITH LESSER CONCENTRATIONS. (2) OZONE DOES NOT AFFECT WATER TASTE, (3) OZONATION COMPLETELY DESTROYS PHENOLS AND COUNTER-ACTS THE ACTION OF DETERGENTS. THE COST OF THE OZONATION PROCESS IS FROM 0.1 CENT TO 0.2 CENTS/1000 GALLONS. AN OZONATION PLANT COSTS ABOUT $5,000 PER MGD FOR EACH PPM OF OZONE, AND A CONCENTRATION OF 1-2 PPM IS USUALLY SATISFACTORY. OZONATION IS NOW BEING USED TO PURIFY WASTE WATER AND AS A TERTIARY STEP FOLLOWING SECONDARY TREATMENT FOR SEWAGE WASTE WATER. (W71-12052).

00636. AN ASSESSMENT OF POLYELECTROLYTES FOR SLUDGE CONDITIONING AT WORTHING.

SLEETH, R.E.
WATER POLLUTION CONTROL, 69(1) 31-38.

RETEN, FLOCCOTAN, MAGNAFLOC, AND DECAPOL WERE STUDIED IN FULL SCALE PLANT EXPERIMENTS TO ASSESS THEIR RELATIVE MERITS FOR SLUDGE CONDITIONING. SLUDGE WAS COLLECTED FROM TWO TREATMENT PLANTS, ONE WITH A 1.3 MGD CAPACITY, AND ONE OF 4.8 MGD CAPACITY. THE TESTS WERE PERFORMED TO DETERMINE THE VALIDITY OF CLAIMS MADE ABOUT THE POLYELECTROLYTES. THESE ADVANTAGES INCLUDED: (1) POLYELECTROLYTES ARE INERT AND THEY WOULD BE LESS SUSCEPTIBLE TO BACTERIAL INHIBITION, (2) ONLY A SINGLE CHEMICAL WOULD BE USED, FACILITATING CONTROL, (3) REDUCED CHEMICAL DOSAGE WOULD REDUCE STORAGE AND COST REQUIREMENTS; (4) POLYELEC-

TROLYTES, IN A CLEAN WHITE POWDER FORM, WOULD IMPROVE HANDLING CONDITIONS, AND (5) EXISTING PLANTS COULD USE POLYELECTROLYTES WITHOUT EXTENSIVE MODIFICATION. DISADVANTAGES KNOWN TO EXIST WERE: (1) A SPECIAL PROCEDURE WAS NEEDED TO PREPARE SOLUTIONS OF THE CHEMICAL FOR INTRODUCTION TO THE WASTE, AND (2) DIFFICULTIES MIGHT BE ENCOUNTERED IN CONTROLLING THE ADDITION OF SMALL AMOUNTS OF AN EXPENSIVE MATERIAL. TEST RESULTS SHOWED THAT ALL POLYELECTROLYTES PERFORMED BETTER THAN LIME AND COPPERAS, WITH FLOCCOTAN BEING THE OPTIMUM FOR THIS PARTICULAR APPLICATION. IN ADDITION, ESTIMATED SAVINGS BASED ON INITIAL PERFORMANCE WOULD BE APPROXIMATELY 1500 POUNDS PER YEAR. THE VALIDITY OF ALL ORIGINALLY CLAIMED ADVANTAGES WAS SUBSTANTIATED, WHILE THE DISADVANTAGES PROVED TO BE INSIGNIFICANT. (W71-12055)

00637. OPTIMIZATION STUDIES OF TWO WATER PURIFICATION SYSTEMS.

DENCHFIELD, T.D.
SELECTED PORTIONS OF A MASTER'S THESIS, KANSAS STATE UNIVERSITY, 1967, P 102-170.

THE AMERICAN OIL COMPANY'S SUGAR CREEK REFINERY WASTE TREATMENT LAGOON WAS THE PARTIAL PATTERN FOR A MATHEMATICAL LAGOON MODEL, WITH SEVERAL OF THE MODEL'S CONSTANTS BEING DERIVED FROM THE OPERATIONAL DATA OF THE LAGOON. SEPARATE MODELS WERE INITIALLY DEVELOPED FOR THE BIODEGRADATION KINETICS, FLOW THROUGH THE LAGOON, AND ECONOMICS OF THE PROCESS. BOTH THE BIODEGRADABLE AND NON-BIODEGRADABLE COMPONENTS, AS WELL AS THE CHEMICAL OXYGEN DEMAND, WERE ACCOUNTED FOR IN THE KINETICS MODEL. THE ECONOMICS MODEL INCLUDED LAND COST, AERATOR SIZING AND COST, ELECTRIC POWER, AND STRUCTURES. THE OBJECTIVE OF THESE PERFORMANCE EQUATIONS WAS TO DETERMINE THE VOLUME PER STAGE, THE AERATOR MOTOR SIZE, AND THE NUMBER OF STAGES REQUIRED FOR THE BIODEGRADATION SECTION OF AN AERATION, AT THE SAME TIME MINIMIZING THE COST. THE SUGAR CREEK AERATION BASIN IS USED AS A SAMPLE PROBLEM, AND ALL COMPUTATIONAL ROUTINES USED ARE ILLUSTRATED. (W71-12059)

00638. REMOVAL OF ORGANICS FROM WASTE WATER BY ACTIVATED CARBON.

ENGLISH, J.N.; MASSE, A.N.; CARRY, C.W.; PITKIN, J.B.; HASKINS, J.E.
CHEMICAL ENGINEERING PROGRESS, SYMPOSIUM SERIES, 67(107), 147-153, 1970.

A 0.3 MILLION GAL./DAY, FOUR-STAGE, FIXED-BED, GRANULAR ACTIVATED CARBON PILOT PLANT, COMPLETE WITH THERMAL REGENERATION FACILITIES, CONTINUOUSLY TREATED UNFILTERED, ACTIVATED SLUDGE WASTEWATER TREATMENT PLANT EFFLUENT FOR A FOUR-YEAR PERIOD. HIGH QUALITY PRODUCT WATER CHARACTERIZED BY A COD OF 10 MG./LITER WAS PRODUCED ON A ROUTINE BASIS. A 17% DECREASE IN CARBON CAPACITY OCCURRED BETWEEN THE FIRST AND FOURTH CYCLES (ONE CYCLE PER YEAR), AT WHICH TIME A STEADY STATE CONDITION WAS ESTABLISHED AT A CAPACITY BETWEEN 45 TO 50 LB. OF DISSOLVED COD PER 100 LB. OF CARBON. REGENERATION OF THE CARBON WAS SHOWN TO BE A FEASIBLE PROCESS AND SUCCESSFUL BACKWASHING OF THE FIRST STAGE CARBON, WHICH SERVES AS A FILTER AND AN ADSORBER, MADE PRETREATMENT OF THE WASTE WATER TREATMENT PLANT EFFLUENT UNNECESSARY. THE ESTIMATED COST OF $56 PER MILLION GALLONS, FOR A 10-MILLION GAL/DAY CARBON PLANT IS BASED ON A FOURTH CYCLE DOSAGE OF 350 LB. OF CARBON PER MILLION GALLONS OF WATER AND A CONSERVATIVE CARBON LOSS OF 10% PER CYCLE. (W71-12195)

00639. PHOSPHOROUS REMOVAL FROM WASTE WATER BY ACTIVATED ALUMINA COLUMNS.

CULP, G.L.; AMES, L.L.JR.
CHEMICAL ENGINEERING PROGRESS SYMPOSIUM SERIES, 67(107), 304-309, 1971.

ALUMINA, A PHOSPHORUS SELECTIVE ADSORBENT, WAS USED IN A TERTIARY CHEMICAL PROCESS FOR PHOSPHORUS REMOVAL FROM WASTE WATER. THE PROCESS WAS SCALED UP FROM LABORATORY SIZE TO A 25 GAL/MIN MOBILE PILOT PLANT. THE PILOT PLANT WAS DESIGNED TO FIT A STANDARD 40 FT. VAN TRAILER. SECONDARY EFFLUENT WAS PASSED THROUGH A MULTIMEDIA FILTER BED AND STORED IN AN EXTERIOR 2,500 GAL. SURGE TANK OF COLLAPSIBLE PLASTIC. FROM THIS TANK, FILTERED SEWAGE WAS PUMPED TO COLUMNS CONTAINING 150-160 GAL. OF ALUMINA. AFTER PHOSPHORUS LOADING AN ALUMINA COLUMN WAS TAKEN OFF THE LINE AND 800 GAL. OF 1 M NOAH WAS USED TO REMOVE THE ADSORBED ACID BY RECIRCULATION. COLUMN WASHING FOLLOWING THE ELUTION CYCLE WAS PH CONTROLLED. USED NAOH WAS PUMPED FROM THE CAUSTIC MAKEUP TANK TO THE MIXING TANK AND LIME ADDED TO PRECIPITATE PHOSPHORUS IN THE FORM OF SOLID HYDROXLAPATITE. THE SOLIDS WERE REMOVED IN A CONTINUOUS CENTRIFUGE AND THE NAOH RETURNED TO THE MAKEUP TANK FOR REUSE. INITIAL OPERATING COSTS FOR THE STUDY WERE 5.8 CENTS/1000 GAL. OPERATION OF AN ALUMINA PILOT PLANT IN SEVERAL GEOGRAPHIC LOCATIONS WOULD BE DESIRABLE TO DETERMINE THE EFFECTS OF INFLUENT COMPOSITION, AND OTHER OPERATING CONDITIONS, ON PROCESS PERFORMANCE AND ECONOMICS. (W71-12201)

00640. OPTIMIZING A KRAFT MILL WATER REUSE SYSTEM.

LYONS, D.N.; ECKENFELDER, W.W.JR.
CHEMICAL ENGINEERING PROGRESS, SYMPOSIUM SERIES, 67(107), 381-387.

IN DETERMINING THE OPTIMUM QUALITY OF WATER RECOVERY AND REUSE A GENERALIZED MATHEMATICAL MODEL WAS DEVELOPED. THE MODEL AND ASSOCIATED METHODOLOGY WERE APPLIED TO THE WATER MANAGEMENT SYSTEM OF A MEDIUM SIZE BLEACHED KRAFT PULP MILL. THROUGH THE OPTIMIZATION OF THIS PROBLEM, THE REUSE OF WATER RECLAIMED FROM INDUSTRIAL WASTE WATER WAS ACCOMPLISHED BY UTILIZING THE MATHEMATICAL MODEL DEVELOPED. THE COST SOLUTION CONSIDERED THE EFFECTS OF VARIATIONS IN PRODUCTION PROCESS WATER QUALITY REQUIREMENTS, COST AND QUALITY OF FRESHWATER AND RECLAIMED WATER AND THE COST OF EFFLUENT TREATMENT. THE APPLICATION OF THE MODEL TO THE PULP AND PAPER MILL INDICATED THAT HIGH LEVELS OF RECYCLE COULD BE ECONOMICALLY JUSTIFIED IF STRINGENT COLOR STANDARDS FOR WASTE WATER EFFLUENTS REQUIRED A HIGH DEGREE OF BIOLOGICAL TREATMENT. THE KEY TO THE PROCESS OF RECLAIMING USABLE WATER FROM THE PULP AND PAPER MILL WAS COLOR REMOVAL. (W71-12207)

COST ANALYSIS OF WATER POLLUTION CONTROL

00641. TAHOE AND WINDHOEK: PROMISE AND PROOF OF CLEAN WATER.

SEBASTIAN, F.P.
CHEMICAL ENGINEERING PROGRESS, SYMPOSIUM SERIES, 67(107), 410-412, 1971.

TECHNICAL AND ECONOMIC ACHIEVEMENTS IN WATER RECLAMATION HAVE BEEN DEMONSTRATED IN FULL-SCALE OPERATIONS AT LAKE TAHOE, CALIFORNIA, AND WINDHOEK, SOUTH WEST AFRICA. AT THESE LOCATIONS IT HAS BEEN SHOWN THAT SEWAGE EFFLUENT CAN BE SAFELY TREATED TO PRODUCE DRINKING QUALITY WATER. THE PLANT AT TAHOE CONSISTS OF A CONVENTIONAL ACTIVATED SLUDGE PLANT WITH AN ADDED TERTIARY SYSTEM. A SIGNIFICANT STEP IN COMPATIBILITY OF THERMAL RECLAMATION PROCESSES USED AT TAHOE IS THE DEVELOPMENT OF EXHAUST GAS CLEANING DEVICES THAT COOL AND CLEAN THE GASES SO EFFECTIVELY THAT PARTICULATE MATTER IS UNMEASURABLE. IN THE FIRST YEARS OF OPERATION THE EFFLUENT WAS BETTER THAN THE STANDARDS SET. THE MEDIAN BOD WAS 0.98 MG/LITER AND THE MEDIAN COD WAS 10.83 MG/LITER. THE TOTAL OPERATING COST OF THE TERTIARY PROCESS BASED ON 7.5 MILLION GAL/DAY IS 14 CENTS/1000 GAL. AND THE AMORTIZATION COST IS 8.75 CENTS/1000 GAL. WHILE THE INCREMENTAL COST ABOVE SECONDARY TREATMENT IS 1.5 CENT/PERSON/DAY. DURING TRIAL RUNS UNDERTAKEN TO STUDY THE OVERALL PERFORMANCE OF THE PLANT, TEST WORK INCLUDED A DETERMINATION OF THE FATE OF POLIO VIRUSES, BACTERIA, AND PARASITES. TESTS SHOWED LITTLE OR NO VIRUSES WERE PRESENT PASSING INTO THE CHLORINATION TANK GIVING NO INDICATION AS TO THE EFFECTIVENESS OF THE LEVELS OF CHLORINE USED. AS A RESULT OF THE TESTS IT WAS SHOWN THAT COMPLETELY ACCEPTABLE WATER COULD BE PRODUCED FROM SPECIFIED SEWAGE EFFLUENTS. (W71-12209).

00642. ECONOMICS OF REGIONAL WASTE TRANSPORT AND DISPOSAL SYSTEMS.

TOMPSON, T.I.; SNOEK, P.E.; WASP, E.J.
CHEMICAL ENGINEERING PROGRESS, SYMPOSIUM SERIES, 67(107), 413-422, 1971.

A STUDY WAS SPONSORED BY THE FEDERAL WATER QUALITY ADMINISTRATION DETERMINING THE TECHNICAL FEASIBILITY AND ECONOMICS OF TRANSPORTING SEWAGE TREATMENT PLANT SLUDGE AND OTHER SELECTED WASTES BY AVAILABLE TRANSPORT SYSTEMS FOR LAND AND OCEAN DISPOSAL. THE GENERAL REGION SELECTED FOR STUDYING LAND DISPOSAL WAS THE GREAT LAKES MEGALOPIS EXTENDING FROM BUFFALO TO MILWAUKEE, WHILE OCEAN DISPOSAL WAS INVESTIGATED ALONG THE ATLANTIC COAST MEGALOPOLIS FROM BOSTON TO NORFOLK. EVALUATION OF REGIONAL SLUDGE TRANSPORT AND DISPOSAL SYSTEMS WAS TAKEN OF THE NORTHEAST OHIO AREA. AN AREA EVALUATION DISPLAYED THE ULTIMATE DISPOSAL SYSTEM AS BEING A 12 IN. PIPELINE EXTENDING FROM THE CLEVELAND AREA SOUTHERLY TO HARRISON. 5-MILE OUTFALL TO SHELF WATERS (60 FT. DEPTH) AND AN 80 MILE OUTFALL TO THE EDGE OF THE CONTINENTAL SHELF (650 FT DEPTH) WERE EVALUATED. THE OCEAN DISPOSAL SYSTEM WOULD HAVE 2 PIPELINE COLLECTION BRANCHES MAINLINING FROM AN 18 IN. DIAMETER LINE. IN CONCLUSION UTILIZATION OF LONG DISTANCE PIPELINES CAN EXTEND THE RADIUS OF POTENTIAL SITES BY HUNDREDS OF MILES. TWO MAJOR POINTS MENTIONED WERE (1) LAND RECLAMATION AND UPGRADING OF MARGINAL LANDS WITH DIGESTED SLUDGE IS AN ECONOMICAL AND ECOLOGICALLY DESIRABLE METHOD OF SLUDGE DISPOSAL, AND (2) PIPELINES OFFER LOW COSTS MEANS OF TRANSPORTING WASTES TO AREAS WHERE THEY CAN BE USED IN AN ENVIRONMENTALLY BENEFICIAL MANNER AT RATES OF $1.60/TON/25 MI. (W71-12210).

00643. PILOT DEMONSTRATION OF BASIC DESIGNS FOR ANAEROBIC TREATMENT OF PETROCHEMICAL WASTES.

FISHER, J.A.; HOVIOLS, J.C.; KUMKE, G.W.; CONWAY, R.A.
CHEMICAL ENGINEERING PROGRESS, SYMPOSIUM SERIES, 67(107) 485-494, 1971.

IN ORDER TO INCREASE THE SCOPE OF STUDY ON ANAEROBIC SYSTEMS AND TO DEVELOP AND DISSEMINATE INFORMATION IN A FORM USEFUL TO OTHERS, A RESEARCH GRANT WAS AWARDED BY THE FEDERAL WATER QUALITY ADMINISTRATION FOR PARTIAL SUPPORT OF IN-DEPTH ANAEROBIC TREATMENT STUDIES BY UNION CARBIDE. ANAEROBIC FILTERS AND LAGOONS OPERATING AT LOW MICROORGANISM CONCENTRATIONS WERE USED. AN ANAEROBIC LAGOON EXPERIMENT WAS PERFORMED AT UNION CARBIDE'S TEXAS CITY PLANT UTILIZING ACTUAL WASTE STREAMS. 50 GAL. UNITS WERE USED TO TREAT CONCENTRATED WASTES OF 15,000 MG/LITER COD AT DETENTION TIMES OF 20-40 DAYS. THE EXPERIMENTS CONDUCTED IN THE STUDY SHOWED THAT THE ANAEROBIC LAGOON PROVIDED AN ECONOMICAL METHOD FOR DECREASING OXYGEN DEMAND OF PETROCHEMICAL WASTE WATERS BY ABOUT 40-60% AT LOADING LESS THAN 10 LB. COD/1000 CU FT. /DAY. THE LAGOON IS ALSO UNIQUELY SUITABLE FOR UTILIZING SULFATES FOUND IN PETROCHEMICAL WASTEWATERS PROVIDING ORGANIC REDUCTION BY A SULFUR REDUCTION OXIDATION CYCLE. THE CAPITAL AND OPERATING COSTS OF THE SYSTEM ARE SIGNIFICANTLY LOW. (W71-12222).

00644. WASTE MANAGEMENT...WHAT DOES IT COST.

BERGE, O.I.
HOARD'S DAIRYMAN, VOL 116, APRIL 10, 1971, P 420.

THIS ARTICLE IS AN ECONOMIC PREDICTION OF THE COST FACTORS INVOLVED IN HANDLING WASTES BY DAILY HAULING, STACKING OR LIQUID MANURE. DAILY HAULING REQUIRES THE LEAST INVESTMENT AND LIQUID MANURE SYSTEMS THE MOST. THE ANNUAL COSTS FOR EACH OF THE SYSTEMS ARE MUCH CLOSER THAN THE INVESTMENT FIGURES. THE COST OF THE WASTE HANDLING SYSTEMS MAY BE OFFSET TO A CONSIDERABLE EXTENT BY THE FERTILITY VALUE OF THE WASTES. (W71-12244).

00645. RECONNAISANCE STUDY: FINANCE, ORGANIZATION, MANAGEMENT--NASHUA RIVER WATER QUALITY DEMONSTRATION PROGRAM.

PAGE, P.; PERETTI, D.; SCHNEIDER, A.
UNIV. OF MASSACHUSETTS, AMHERST, WATER RESOURCES RESEARCH CENTER, 1971. 30.

THE NASHUA RIVER WATER QUALITY DEVELOPMENT PROGRAM IS EVALUATED AFTER A FOUR-MONTH SURVEY INCLUDING FINANCING, ORGANIZATION, AND MANAGERIAL ASPECTS. RESULTS INDICATE THAT WATER QUALITY STANDARDS CAN BE MET AT LOWER COSTS OF BOTH BUSINESS AND PUBLIC SECTORS THROUGH COORDINATION AND COOPERATION. THE CONFLICTING INTEREST OF CONSERVATIONISTS AND DEVELOPERS CAN BE RECONCILED BY COOPERATION IN DEVELOPMENT OF GREEN BELTS ALONG THE NASHUA RIVER (MASSACHUSETTS-NEW HAMPSHIRE) WHICH WILL PROVIDE BOTH ENVIRONMENTALLY PROTECTED RECREATION AREAS AND HIGHER

LAND VALUES ADJACENT TO IT. ADVANTAGES AND POSSIBILITIES OF A REGIONAL PLANNING APPROACH ARE POINTED OUT. (PB-202 697) (W71-12332).

00646. ECONOMIC IMPACT OF POLLUTION ABATEMENT.

BRIMMER, A.F.
PRESENTED AT 1971 COMMENCEMENT EXERCISES OF MIAMI UNIV., CORAL GABLES, FLORIDA, JUNE 1971. 19 P.

AN ECONOMETRIC COMPUTER SIMULATION STUDY BY THE FEDERAL RESERVE BOARD INDICATES THAT IT WILL TAKE $16 BILLION TO FINANCE ANTI-POLLUTION CAPITAL INVESTMENTS OVER THE NEXT FOUR OR FIVE YEARS ASSUMING A $3 BILLION INVESTMENT PER YEAR IN POLLUTION ABATEMENT DEVICES FOR BOTH NEW AND EXISTING EQUIPMENT. THESE COSTS MAY PRODUCE A SUBSTANTIAL DRAG ON THE IMPROVEMENT IN THE MATERIAL CONDITIONS OF LIFE OF MANY AMERICANS. WHILE POLLUTION ABATEMENT INVESTMENTS WOULD CREATE MANY NEW JOBS THE RESULTING LOWER PRODUCTIVITY WOULD REDUCE THE GNP GROWTH WHICH WOULD AFFECT PER CAPITA INCOMES OF THOSE UNDERDEVELOPED SECTORS OF OUR ECONOMY WHICH ARE LEAST ABLE TO BEAR IT--THE POOR, THE DISADVANTAGED, AND THE HARD PRESSED URBAN COMMUNITIES. OTHER PROJECTED EFFECTS OF INCREASED INVESTMENT IN POLLUTION ABATEMENT WERE SLIGHT REDUCTIONS IN EXPENDITURES FOR PLANT AND RESIDENTIAL HOUSING, SIZABLE DROPS IN PERSONAL CONSUMPTION AND, MOST DISTURBING, A STRONG INFLATIONARY PRICE TREND. (W71-12341).

00647. WATER QUALITY ASPECTS OF INTERMITTENT SYSTEMS USING SECONDARY SEWAGE EFFLUENT.

BOUWER, H.
PAPER NO 8 OF ARTIFICIAL GROUNDWATER RECHARGE CONFERENCE, UNIVERSITY OF READING, ENGLAND, SEPTEMBER 21-24, 1970: THE WATER RESEARCH ASSOCIATION, MARLOW, ENGLAND. 19 P.

AN EXPERIMENTAL PROJECT ON RECLAIMING WATER FROM SECONDARY SEWAGE EFFLUENT BY GROUNDWATER RECHARGE WITH INFILTRATION BASINS IN THE DRY SALT RIVER BED NEAR PHOENIX, ARIZONA, SHOWS THAT THE INFILTRATION RATE IN GRASS-COVERED BASINS IS 25% HIGHER, AND IN GRAVEL-COVERED BASINS 50% LOWER, THAN IN A BARE SOIL BASIN. ALTERNATING 2-WEEK INUNDATION PERIODS WITH 10 DAY DRY-UP PERIODS (17 DAYS IN WINTER) YIELD AN ANNUAL INFILTRATION RATE OF ABOUT 100 M (330 FT). THE HYDROGEOLOGICAL CONDITIONS OF THE SALT RIVER BED, ABOUT 0.9 M (3 FT) OF FINE, LOAMY SAND UNDERLAYED BY SAND AND GRAVEL LAYERS TO GREAT DEPTH AND A GROUNDWATER TABLE OF ABOUT 3 M (10 FT) DEPTH, ARE FAVORABLE FOR HIGH-RATE WASTE WATER RECLAMATION BY GROUNDWATER RECHARGE. RECLAIMED WATER, PUMPED FROM 9 M (30 FT) DEPTH IN THE CENTER OF THE RECHARGE AREA, HAS A BIOCHEMICAL OXYGEN DEMAND OF ABOUT 0.5 MG/LITER (BOD OF THE SEWAGE EFFLUENT IS ABOUT 15 MG/LITER) AND A MEDIAN FECAL COLIFORM DENSITY OF 1 PER 100 ML. NITROGEN, WHICH IS ALMOST ALL IN THE AMMONIUM FORM AT A CONCENTRATION OF 25 PPM N IN THE SEWAGE EFFLUENT, IS ESSENTIALLY ALL CONVERTED TO THE NITRATE FORM IN THE RECLAIMED WATER IF SEQUENCES OF SHORT INUNDATION PERIODS (3 DAYS OR LESS) ARE HELD. PHOSPHATE CONCENTRATION IN THE RECLAIMED WATER PUMPED FROM 30 FOOT DEPTH IN THE CENTER OF THE RECHARGE AREA IS AROUND 10 PPM P, AS COMPARED TO 26 PPM IN THE EFFLUENT. TO RECLAIM THE SEWAGE FLOW OF 370 MILLION CU M PER YEAR THAT IS EXPECTED IN THE PHOENIX AREA BY THE YEAR 2000, ABOUT 370 HA (950 ACRES) OF INFILTATION BASINS WOULD RE REQUIRED. COST OF RECLAIMING WATER IN THIS MANNER WOULD BE ABOUT $4 PER 1000 CU M. (W71-12411).

00648. TAXING U.S. POLLUTERS.

MOSS, L.
SATURDAY REVIEW, AUGUST 7, 1971, P 51.

A TREMENDOUS AMOUNT OF POLLUTION IS CAUSED BY THE EMISSION OF SULFUR OXIDES. NO METHOD IS PRESENTLY AVAILABLE TO REDUCE SUCH EMISSIONS. IT IS UNLIKELY THAT INDUSTRY DESIRES SUCH TECHNOLOGY AS THEY WOULD HAVE TO PAY THE COST OF IMPLEMENTATION. POLLUTION TAXES, HOWEVER, WOULD MOTIVATE INDUSTRY TO DEVELOP AND IMPLEMENT POLLUTION REDUCTION DEVICES. THIS APPROACH WOULD ALSO BE THE CHEAPEST METHOD OF ACHIEVING ENVIRONMENTAL QUALITY. THE AUTHOR RECOMMENDS THE FOLLOWING PROPOSALS: (1) A TAX OF 20 CENTS PER POUND OF SULFUR, (2) A UNIFORM APPLICATION OF THE TAX THROUGHOUT THE NATION, AND (3) REVENUE FROM THE SULFUR TAX SHOULD GO INTO A GENERAL FUND RATHER THAN A TRUST FUND. OTHER CANDIDATES FOR POLLUTION TAXES ARE NITROGEN OXIDES, CARBON MONOXIDES, HYDROCARBONS, PARTICULATE MATTER IN THE AIR, AND THE BIOLOGICAL OXYGEN DEMAND MADE BY EFFLUENTS IN WATER. (W71-12893).

00649. REVIEW OF NATIONAL RESEARCH POLICY ON EUTROPHICATION PROBLEMS.

DOWNING, A.L.
JOURNAL OF THE SOCIETY FOR WATER TREATMENT AND EXAMINATION, 19, PART 3, 223-238, 1970.

FOR NEW WATER SUPPLIES AND FOR GREATER RECREATIONAL EXPLOITATION OF NATURAL WATERS IN THE UNITED KINGDOM, APPROPRIATE LEVELS OF ACTIVITY AND LINES OF INQUIRY ARE NEEDED. COST INCURRED AS A RESULT OF EUTROPHICATION WILL PROBABLY NOT INCREASE TO MORE THAN ABOUT DOUBLE THE PRESENT EXPENDITURES BY THIS CENTURY'S END. IF ALGAL GROWTH WERE FULLY UNDERSTOOD, PERHAPS SOME COMPARATIVELY SIMPLE PREVENTIVE MEASURES COULD BE APPLIED FOR ELIMINATING THESE NUISANCES. A BALANCED PROGRAM IS REQUIRED FOR BASIC RESEARCH AND FOR EMPIRICAL INVESTIGATIONS, ESPECIALLY ON STATIC WATERS. SINCE FACTORS INFLUENCING ALGAL GROWTH VARY GEOGRAPHICALLY, EXAMINING THE INFLUENCES OF LOCATION OF WATER MAY SHOW THAT ONE METHOD OF CONTROL MAY BE MORE APPROPRIATE THAN ANOTHER. THOUGH IT IS UNLIKELY ELIMINATION OF PHOSPHATES FROM DETERGENTS WOULD MATERIALLY REDUCE ALGAL PROBLEMS, SEARCH FOR TROUBLE-FREE SUBSTITUTES SHOULD CONTINUE. PROCESSES USED IN REMOVING NITROGEN AND PHOSPHORUS FROM EFFLUENTS SHOULD BE EXAMINED FOR SUITABILITY OF REMOVING OTHER SUBSTANCES (CARBON ADSORPTION, OZONATION), AND ABILITY OF EFFLUENTS TO SUPPORT ALGAL GROWTH BY UNSUSPECTED COMPONENTS IS PROFOUNDLY IMPORTANT. GROWTH OF WEEDS IN RIVERS AND EFFECT OF SEWAGE EFFLUENT ON CLADOPHORA NEEDS INVESTIGATION. INSURING THAT PRESENT EFFORTS ARE WELL COORDINATED TAKES PRECEDENCE OVER EMBARKING ON MANY NEW INITIATIVES. (W71-13172).

COST ANALYSIS OF WATER POLLUTION CONTROL

00650. DEMINERALIZATION OF RECLAIMED WATER.

DRYDEN, F.D.
INDUSTRIAL WATER ENGINEERING, 8(7) 24-26, 1971.

THE POMONA, CALIFORNIA, PILOT STUDY FOR RECLAIMING WASTE WATERS PROVIDED A COMPARATIVE EXAMINATION OF THREE DEMINERALIZATION PROCESSES: REVERSE OSMOSIS, ELECTRODIALYSIS, AND ION EXCHANGE. RESULTS INDICATE THAT WASTEWATER DEMINERALIZATION IS AN ECONOMICAL ALTERNATIVE TO SEAWATER DEMINERALIZATION. STRONG ACID-WEAK BASE ION EXCHANGE SO FAR APPEARS MORE ECONOMICAL AND RELIABLE THAN THE REVERSE OSMOSIS AND ELECTRODIALYSIS SYSTEMS, FOR THE TDS RANGE OF INTEREST. PRACTICAL REDUCTIONS IN DISOLVED SOLIDS CAN BE OBTAINED AT COSTS OF 20-30 CENTS/1000 GAL WHERE BRINES CAN BE DISCHARGED INTO THE OCEAN. SINCE EACH OF THE THREE PROCESSES SUBJECT TO FOULING IN THE PRESENCE OF HIGH CONCENTRATIONS OF ORGANIC MATTER, ACTIVATED CARBON ADSORPTION IS CONSIDERED AN INTEGRAL PART OF THESE DEMINERALIZATION SCHEMES. THE COST OF ACTIVATED CARBON TREATMENT IS ESTIMATED AT 9 CENTS/1000 GAL FOR A 10 MGD FACILITY, WHICH MUST BE ADDED TO THE SEPARATE DEMINERALIZATION COST. (W71-13291).

00651. INVESTIGATION OF A NEW PHOSPHATE REMOVAL PROCESS.

SOFFER, L.M.; LOWELL, J.R.JR; LORAN, B.I.
WATER POLLUTION CONTROL RESEARCH SERIES, NOVEMBER 1970. 75 P.

TWO NEW TYPES OF RESINS WERE SUBJECTED TO LABORATORY EVALUATIONS OF THEIR TECHNICAL AND ECONOMIC FEASIBILITY FOR USE IN PHOSPHATE REMOVAL. MULTI-VALENT METAL DERIVATIVES OF SULFONIC ACID RESINS WERE FOUND TO HAVE GOOD PHOSPHORUS CAPACITIES. THE IRON (III) FORM OF AMBERLITE 200 STRONG ACID CATION EXCHANGE RESIN, FOR EXAMPLE, EXHIBITED CAPACITIES OF UP TO 9.5 MG P/ML OF WET RESIN, AND IN TESTS WITH SECONDARY EFFLUENT, A 2.7 MG P/ML CAPACITY WAS OBTAINED. EXHAUSTED RESIN WAS EASILY REGENERABLE WITH DILUTE FERRIC CHLORIDE SOLUTION, AND AFTER TEN EXHAUSTION-REGENERATION CYCLES WERE PERFORMED ON ONE SAMPLE, NO DETECTABLE LOSS OF PHOSPHORUS CAPACITY WAS OBSERVED. THE IRON AND PHOSPHORUS REMOVED FROM THE WASTE WATER AND CONCENTRATED IN THE WASTE BRINE WERE SUBSEQUENTLY REMOVED FROM THE WASTE BRINE BY LIME ADDITION AND SETTLING. A THOROUGH COST ANALYSIS INCLUDING BOTH FIXED CONSTRUCTION COSTS AS WELL AS OPERATION AND MAINTENANCE COSTS, ESTABLISHED THE PRICE OF WASTE WATER TREATMENT BY THIS METHOD AS 34.38 CENTS/1000 GAL. THE SECOND RESIN TYPE REMOVED ONLY 25 TO 35% AS MUCH PHOSPHORUS AS COMMERCIALLY AVAILABLE RESINS AND WAS THEREFORE DISMISSED. (PB-203-069) (W71-13309).

00652. DIGITAL COMPUTER SIMULATION OF WASTE WATER TREATMENT.

CUMMINGS, P.W.JR.
MASTER'S THESIS, UNIVERSITY OF MASSACHUSETTS, AUGUST 1969. 171 P.

THE BASIC ACTIVATED SLUDGE WASTE WATER TREATMENT WAS SIMULATED UNDER THE DIRECTION OF ROBERT SMITH AT THE CINCINNATI WATER RESEARCH LABORATORY. THIS COMPUTER SIMULATION WAS THEN USED AS THE BASIS FOR FURTHER MODIFICATION AND REFINEMENT. FOLLOWING CONCEPTION, CONSTRUCTION, AND TESTING OF THE MODIFICATIONS, NEW SUBROUTINES INCORPORATING THE MODIFICATIONS WERE INTEGRATED INTO THE ORIGINAL PROGRAM. DEVELOPMENTS MODELED IN THIS MANNER INCLUDED: (1) THE EXCLUSION OF PRIMARY SETTLING; (2) AEROBIC SLUDGE DISESTION; AND (3) A MORE THOROUGH ANALYSIS OF SAND BED SLUDGE DEWATERING TECHNIQUES. COST ANALYSES INDICATED THAT OMISSION OF PRIMARY SEDIMENTATION WOULD RESULT IN OVERALL SAVINGS OF FROM 7.53% TO 11.01% AS COMPARED TO CONVENTIONAL ACTIVATED SLUDGE WITH PRIMARY TREATMENT. SAND BED SLUDGE DRYING WAS COMPARED WITH VACUUM FILTRATION AND INCINERATION AND AT 2.4 CENTS/1000 GALLONS, WAS FOUND TO BE CONSIDERABLY MORE ECONOMICAL. ANAEROBIC AND AEROBIC SLUDGE DIGESTION WERE OF NEARLY THE SAME COST, BUT IF SAND BED SLUDGE DRYING WAS TO BE USED, A SUBSTANTIAL FINAL SAVINGS WOULD BE REALIZED FROM AEROBIC DIGESTION DUE TO THE BETTER DEWATERING CHARACTERISTICS OF AEROBICALLY DIGESTED SLUDGES. (W71-13316).

00653. WASTEWATER RECLAMATION IN A CLOSED SYSTEM.

BESIK, F.
WATER AND SEWAGE WORKS, 118(7), 213-219, 1971.

A CLOSED WATER-WASTEWATER TREATMENT SYSTEM WAS ASSEMBLED FROM COMPONENTS PRESENTLY AVAILABLE. THE FIRST STEP WAS COAGULATION-CLARIFICATION FOR THE REMOVAL OF SUSPENDED SOLIDS WITH THE PARALLEL REMOVAL OF PHOSPHATES. LIME AND ALUM WERE FOUND SUITABLE FOR USE AS PRIMARY COAGULANTS, WITH OR WITHOUT POLYELECTROLYTE COAGULANTS, WITH OR WITHOUT POLYELECTROLYTE COAGULANT AIDS. NEXT, AIR STRIPPING WAS EMPLOYED TO REMOVE SOLVENTS (SUCH AS ACETONE, METHYLETHLKETONE, AND OTHER LOW MOLECULAR WEIGHT HYDROCARBONS), VOLATIVE GASES (HYDROGEN SULFIDE, METHANE, CARBON DIOXIDE, CHLORINE, AND AMMONIA), AND THEIR ASSOCIATED TASTES AND ODORS. HARDNESS AND ORGANIC CARBON ARE ALSO REMOVED TO A CERTAIN EXTENT. REVERSE OSMOSIS UNITS ARE THEN USED TO PROVIDE 90 TO 98% REMOVAL OF BIVALENT IONS AND 70 TO 90% REMOVALS OF MONOVALENT IONS. REMAINING MATERIAL WAS THEN SHOWN TO CONSIST MOSTLY OF MONOVALENT IONS (SODIUM, POTASSIUM, CHLORIDE, NITRATES, ETC.) AND LOW MOLECULAR WEIGHT ORGANICS. EFFLUENT FROM THE REVERSE OSMOSIS UNITS WAS CHEMICALLY OXIDIZED WITH OZONE AND SUBJECTED TO CARBON ADSORPTION POLISHING. COST ESTIMATES REVEALED A 55% INITIAL COST SAVINGS AND A 45% YEARLY OPERATIONAL SAVINGS FOR A CLOSED SYSTEM AS OPPOSED TO CONVENTIONAL SEPARATE WATER TREATMENT FACILITIES. (W71-13406).

00654. POLYELECTROLYTE CONDITIONING OF ALUM SLUDGE.

ARGO, D.G.
MASTER'S THESIS, MARCH 1971, 94 P.

LIME SLUDGES, ONE FROM A PHOSPHORUS PRECIPITATION PROCESS AND ONE FROM AN EXCESS LIME COLOR REMOVAL PROCESS, WERE CONDITIONED WITH VARIOUS POLYELECTROLYTES. ANALYTICAL TESTS INCLUDED SPECIFIC RESISTANCE, COD, TOTAL AND VOLATILE SOLIDS, PH, AND ZETA POTENTIAL. POLYELECTROLYTE CONDITIONED AND UNCONDITIONED SAMPLES WERE APPLIED TO BENCH-SCALE SAND BEDS TO DETERMINE THE EFFECT OF CONDITIONING ON GRAVITY DEWATERING AND AIR DRYING. SPECIFIC RESISTANCE WAS DETERMINED TO BE AN EFFECTIVE CONTROL PARAMETER, AND IT WAS REDUCED SIGNIFICANTLY ONLY BY ANIONIC

POLYELECTROLYTES. SLUDGES SO CONDITIONED PRODUCED A POROUS, OPEN FLOC STRUCTURE, PRINCIPALLY THROUGH CHEMICALLY BRIDGING, WHICH FACILITATED GRAVITY DRAINING AND AIR DRYING. ADEQUATE POLYMER DISPERSION WAS REQUIRED, BUT EXCESS TURBULENCE DESTROYED THE FLOC STRUCTURE. PH WAS SHOWN TO HAVE NO DETECTABLE EFFECT, WHEREAS THE EFFECTS OF VARYING SOLIDS CONCENTRATIONS WERE QUITE NOTICEABLE. AN AVERAGE COST OF $934 PER MILLION GALLONS OF SLUDGE TREATED WAS REPORTED. A FIGURE LOW ENOUGH TO JUSTIFY THE ECONOMIC FEASIBILITY OF THE PROCESS. (W71-13530).

00655. NITROGEN AND PHOSPHORUS REMOVAL: METHODS AND COSTS.

BAYLEY, R.W.
WATER TREATMENT AND EXAMINATION, VOL 19, 294-319, 1970.

IN SOME PARTS OF WESTERN EUROPE AND THE USA WHERE EUTROPHICATION OF SURFACE WATERS HAS BEEN A PROBLEM, METHODS OF REMOVING NUTRIENTS, PHOSPHORUS AND NITROGEN, FROM EFFLUENTS HAVE BEEN STUDIED EXTENSIVELY. A FEW FULL-SCALE PLANTS NOW DISCHARGE TREATED EFFLUENTS WITH LOW CONCENTRATIONS OF THESE ELEMENTS. MOST OF THESE METHODS COULD BE APPLIED IN BRITAIN IF THE COST-BENEFIT ANALYSIS PROVED FAVORABLE. SEVERAL PROCESSES FOR REMOVING PHOSPHORUS ARE PRESENTED AND DISCUSSED: BIOLOGICAL TREATMENT, CHEMICAL PRECIPITATION AND SELECTIVE ION EXCHANGE. PROCESSES FOR REMOVING NITROGEN FROM WASTE WATERS ARE PRESENTED AND DISCUSSED: BIOLOGICAL TREATMENT, NITRIFICATION AND DENITRIFICATION, AIR STRIPPING AND ION EXCHANGE. COSTS FOR THESE PROCESSES ARE ESTIMATED AND THE EFFICIENCIES TO BE EXPECTED ARE PRESENTED. ADVANCED TREATMENT PROCESSES, REVERSE OSMOSIS, DISTILLATION AND ELECTROLYSIS, ARE MENTIONED BRIEFLY. LONG TERM PROSPECTS FAVOR ENHANCING BIOLOGICAL TREATMENT, ESPECIALLY NITRIFICATION FOLLOWED BY DENITRIFICATION, TO REMOVE NUTRIENTS. HOWEVER, THERE IS GREAT INTEREST IN THE DEVELOPMENT OF NON-BIOLOGICAL WASTE TREATMENT SYSTEMS AND PHYSICO-CHEMICAL PROCESSES MAY BE USED TO A GREATER ADVANTAGE IN ONE OF THESE. (W71-13544).

00656. ROTARY PRECOAT FILTRATION OF SLUDGE FROM ACID MINE DRAINAGE NEUTRALIZATION.

BROWN, T.S.
ENVIRONMENTAL PROTECTION AGENCY, WATER POLLUTION CONTROL RESEARCH SERIES, MAY 1971. 121 P.

A TWO YEAR STUDY WAS CONDUCTED AT 4 LOCATIONS IN PENNSYLVANIA TO TEST THE EFFECT OF VARIOUS ALKALIES AND FILTER AIDS ON ROTARY VACUUM PRECOAT FILTRATION FOR DEWATERING OF LIME NEUTRALIZATION SLUDGE. THE PROCESS CONSISTED OF NEUTRALIZATION, AERATION, SEDIMENTATION AND FILTRATION. ALKALIES INVESTIGATED WERE LIMESTONE, LIMESTONE WITH HYDRATED LIME, CALCINED MAGNESITE, PARTIALLY AND FULLY CALCINED DOLOMITE, AND HYDRATED LIME. FILTER AIDS TESTED INCLUDED HYFLO, SUPER-CEL, AND CELITE 501, 503, AND 545. RESULTS FROM THE FIRST THREE LOCATIONS INDICATED LIMESTONE AND HYDRATED LIME WERE PREFERRED ALKALIES AND CELITE 501, THE PREFERRED FILTER AID. AT THE 4TH SITE A 27 RUN FACTORIAL EXPERIMENT INVESTIGATING THE EFFECT OF FLOW RATE, LIMESTONE FEED LEVEL, AERATION LEVEL, AND SLUDGE RECIRCULATION LEVEL ON EQUIPMENT OPERATION AND PROCESS COST WAS CONDUCTED SLUDGE SOLIDS CONTENT, FILTRATION RATE, AND SLUDGE RECIRCULATION LEVEL ON EQUIPMENT OPERATION AND PROCESS COST WERE CONDUCTED. SLUDGE SOLIDS CONTENT, FILTRATION RATE, AND SLUDGE RECIRCULATION WERE FOUND TO BE SIGNIFICANT VARIABLES AFFECTING PROCESS COST. ESTIMATED OPERATING COSTS FOR A 1.5 MGD TREATMENT PLANT USING LIME NEUTRALIZATION WERE $1.16/1000 GALLONS TREATED OR $8.02 PER 100 LBS OF ACIDITY TREATED. (PB-203 190) (W71-13516).

00657. DEVELOPMENT OF A FROTH PROCESS FOR THE TREATMENT OF SOUR WATER.

WILSON, D.B.
OWRR COMPLETION REPORT, (1970). 30 P.

THE PURIFICATION OF SOUR (H2S) WATER AND THE RECOVERY OF SULFUR WAS ACCOMPLISHED USING A SURFACTANT-CATALYST ONE STEP TREATMENT PROCESS. THE SURFACE ACTIVE MATERIALS WERE CAPABLE OF FORMING STABLE INTERMEDIATES WITH THE H2S, AND THE FOAM GENERATED BY THE SURFACTANT CAUSED THE INTERMEDIATES TO BE CONCENTRATED AT THE AIR-LIQUID INTERFACES OF THE BUBBLES. SUBSEQUENT REMOVAL, COLLAPSE OF THE FOAM, AND SEPARATION OF THE SULFUR PARTICLES ALLOWED THE SURFACTANT TO BE RECYCLED. OF THE THREE SURFACTANT AND SURFACTANT CATALYST SYSTEMS TESTED, SODIUM LAURYL SULFATE PLUS AN ION CATALYST PRODUCED MAXIMUM SULFUR RECOVERY OF 16% BY WEIGHT. ALTHOUGH HYDROGEN SULFIDE CONTENT WAS REDUCED TO LESS THAN 0.1 PPM, RESIDUAL SURFACTANT CONTENT WAS 40 TO 80 PPM, MAKING THE OPERATION ECONOMICALLY UNFEASIBLE BECAUSE OF THE COST OF THE SURFACTANT LOST. UNDER THE OPTIMUM OPERATIONAL CONDITIONS, 16% BY WEIGHT SULFUR RECOVERY AND 40 PPM RESIDUAL SURFACTANT, THE OPERATING EXPENSE WAS DETERMINED TO BE 3.5 MIL/BBL OF 200 PPM H2S WATER TREATED. (PB-203 193) (W71-13519).

00658. WATER CUSTOMERS, CRITERIA, AND COSTS.

FAUST, R.J.
PROCEEDINGS OF THE ELEVENTH SANITARY ENGINEERING CONFERENCE, FEB 5-6, 1969, URBANA, ILLINOIS; ILLINOIS DEPT OF PUBLIC HEALTH AND UNIVERSITY OF ILLINOIS, DEPT OF CIVIL ENGINEERING, P 1-8.

THE DEMAND FOR CLEAN, SAFE WATER HAS A LONG HISTORY OF BATTLES FOUGHT TO CONVINCE THE PUBLIC AND CITY OFFICIALS OF THE VALUES OF FINANCIAL SUPPORT TO MEET THE STANDARDS OF QUALITY WATER. THE LOW STANDARDS OF THE EARLY NINETEENTH CENTURY HAVE EVOLVED TO THE U. S. PUBLIC HEALTH SERVICE'S 'DRINKING WATER STANDARDS' WHICH SERVE AS THE MINIMUM FOR ALL PUBLIC WATER SUPPLIES. WHILE ADEQUATE FOR PUBLIC HEALTH, THESE STANDARDS SAY LITTLE ABOUT SUCH CRITERIA AS TASTE, TURBIDITY, COLOR, RADIOLOGICAL STANDARDS, CORROSIVENESS, AND HARDNESS. TO REMEDY THIS THE AMERICAN WATER WORKS ASSOCIATION HAS APPROVED 'QUALITY GOALS FOR POTABLE WATER. ' THE COST OF MEETING THESE GOALS IS STILL A GREAT FACTOR WHICH VARIES WTIH THE CHEMICAL CONSTITUENTS OF THE CURRENT SUPPLY AND THE POLLUTION CONTROL OF THE RAW WATER SOURCE AND IS ESTIMATED AT FROM 0 TO 20 CENTS PER MONTH PER PERSON OVER A 20-YEAR PERIOD. (W71-13650).

COST ANALYSIS OF WATER POLLUTION CONTROL

00659. APPLICATION OF STATISTICAL DECISION THEORY TO GREAT LAKES MANAGEMENT.

CHAMBERLAIN, S.G.
INTERNATIONAL ASSOCIATION GREAT LAKES RESEARCH, PROCEEDINGS 13TH CONFERENCE GREAT LAKES RESEARCH, P 145-148, 1970.

EFFECTIVE MANAGEMENT OF NATURAL RESOURCE, SUCH AS THE GREAT LAKES BASIN, PRODUCES DECISIONS THAT MINIMIZE OBJECTIVES AT MINIMUM COST. SUCH OPTIMIZATION, HOWEVER, MUST OVERCOME THE COMPLEXITIES AND UNCERTAINTIES INTRINSIC TO ALL LARGE NATURAL RESOURCES. STATISTICAL DECISION THEORY (SDT), ALSO CALLED 'VALUE' OR 'UTILITY THEORY', PROVIDES A METHODOLOGY FOR COMBINING THE PERTINENT COMPLEXITIES AND UNCERTAINTIES SO THAT THE CONSEQUENCES OF ALTERNATIVE DECISIONS BECOME CLEAR. IN SDT, A DECISION TREE DISPLAYS THE PATHS FROM GIVEN STATES OF NATURE TO CONSEQUENCES OF ALTERNATIVE DECISIONS, PROBABILITIES ARE ASSIGNED TO UNCERTAINTIES IN THE STATES, PATHS, AND CONSEQUENCES. UTILITY VALUES ARE ATTACHED TO EACH POTENTIAL ACTION AND CONSEQUENCES TO QUANTIFY COSTS AND BENEFITS; ACTIONS MAXIMIZING EXPECTED UTILITY ARE THEN CHOSEN AS OPTIMAL. TO ILLUSTRATE SDT, A SIMPLIFIED EXAMPLE OF INDUSTRIAL POLLUTION IN THE GREAT LAKES BASIN IS GIVEN. REASONABLE COSTS AND PROBABILITIES ARE ASSOCIATED WITH FOUR POTENTIAL ACTIONS. (1) BUILD AN EFFICIENT TREATMENT PLANT, (2) RESEARCH AND DEVELOP A SECONDARY PROCESSOR, (3) STOCK THE LAKES WITH ROBUST SPECIES, (4) OR DO NOTHING. POSSIBLE CONSEQUENCES OF THESE ACTIONS ARE DEFINED AND UTILITIES ASSOCIATED WITH THEM. EXPECTED UTILITY FUNCTIONS FOR EACH ACTION ARE FOUND, AND THE RESULTING MAXIMIZATION DETERMINED WHEN EACH ACTION WOULD BE OPTIMAL. (W71-13654).

00660. WASTEWATER REUSE.

GAVIS, J.
REPORT NWC-EES-71-003, JULY 1971. 161 P.

THE REPORT EVALUATES THE POTENTIAL FOR WASTEWATER REUSE THROUGH RECLAMATION OF EFFLUENTS FROM ADVANCED WASTEWATER TREATMENT PLANTS. BRIEF DESCRIPTIONS AND REFERENCES INDICATE THE EXTENT OF SUCH PRACTICE AT THE PRESENT TIME AND LIKELY POSSIBILITIES FOR FUTURE DEVELOPMENTS. EMPHASIS IS ON THE RESOURCE VALUE OF WASTEWATER. POTENTIAL FOR RECLAMATION OF USED MUNICIPAL AND INDUSTRIAL WATER IS DISCUSSED IN TERMS OF DIRECT REUSE (RECIRCULATING) AND INDIRECT REUSE (EFFLUENT FROM UPSTREAM USE MIXES WITH STREAMFLOW AND IS WITHDRAWN DOWNSTREAM). ADVANCED TREATMENT TECHNOLOGY IS DESCRIBED BY PROCESSES FOR THE REMOVAL OF CONSTITUENTS IN THE EFFLUENTS, WITH COST DATA AND A REVIEW OF MAJOR PROBLEMS. COMPARISON WITH DESALINATION AND INTERBASIN TRANSFER COSTS IS SUGGESTED. NEED FOR RESEARCH IN EVALUATION AND CONTROL OF VIROLOGICAL HAZARDS IS STRESSED. RELATIONSHIP OF ADVANCED TREATMENT PROCESSES TO SECONDARY TREATMENT PROCESSES IS INCLUDED. AN OPTIMISTIC VIEW IS PRESENTED FOR THE GROWTH OF POPULATION AND INDUSTRY IN THE UNITED STATES. (PB-201 535) (W71-13871).

00661. RADIATION TREATMENT OF INDUSTRIAL WASTE WATERS: AN ECONOMIC ANALYSIS.

MYTELKA, A.I.
ISOTOPES AND RADIATION TECHNOLOGY, 8(4), 444-449, 1971.

THE ECONOMIC FEASIBILITY OF USING RADIATION AS A PRETREATMENT METHOD FOR INCREASING THE BIODEGRADIBILITY OF INDUSTRIAL WASTES PRIOR TO THEIR DISCHARGE INTO INDUSTRIAL OR MUNICIPAL BIOLOGICAL WASTE-TREATMENT PLANTS IS INVESTIGATED. THE METHOD USED WAS TO ASSUME AN ACCEPTABLE RANGE OF TREATMENT COSTS (BASED ON THE COST OF PROCESS WATER) AND THEN TO DESIGN AND ESTIMATE THE COST OF A PLANT TO PROVIDE TREATMENT AT THESE COSTS (BASED ON THE COST OF THE ENERGY SOURCE, COBALT-60, AND ACTUAL PLANT DESIGN). A REACTION RATE THAT WOULD ALLOW THE USE OF RADIATION TREATMENT TO MEET EACH COST WAS THEN CALCULATED. FINALLY, THE CALCULATED REACTION RATE WAS COMPARED TO THAT OBTAINED IN THE LABORATORY. THE TWO WASTES TREATED WERE 2-NAPHTHALENE SULFONIC ACID SODIUM SALT AND CHLORANTINE FAST RED. DEPENDING ON THE WASTE CONSIDERED AND THE ALLOWABLE TREATMENT COSTS, OVERALL OXIDATION-REACTION EFFICIENCIES PRESENTLY OBTAINABLE MUST BE INCREASED BY FACTORS VARYING FROM 2 TO 25 BEFORE RADIATION TREATMENT WILL BE ECONOMICALLY FEASIBLE. THIS WILL NECESSITATE A MAJOR BREAKTHROUGH AND INDICATES A NEED FOR FURTHER WORK ON UNDERSTANDING THE BASIC CHEMISTRY INVOLVED. (W71-13951).

00662. COMBINED WASTEWATER COLLECTION AND TREATMENT FACILITY, MOUNT CLEMENS, MICHIGAN.

MAHIDA, V.U.
PREPRINT, 44TH ANNUAL CONFERENCE, WATER POLLUTION CONTROL FEDERATION, SESSION 4, NO 4, OCTOBER 3-8, 1971, SAN FRANCISCO, CAL. 11 P.

THE CITY OF MOUNT CLEMENS, MICHIGAN, HAS 50 MILES OF COMBINED SEWERS SERVING 3.06 SQUARE MILES, AND 10 MILES OF SANITARY SEWERS PLUS 6 MILES OF STORM SEWERS SERVING AN ADDITIONAL 0.8 SQUARE MILES. INTERCEPTORS WERE DESIGNED TO COLLECT STORMWATER OVERFLOWS FROM TWO LOCATIONS ON THE COMBINED SEWERS, SERVING 212 ACRES, AND PUMP IT TO A SMALL LAKE. THIS FIRST LAKE PROVIDED SETTLING, NATURAL AND MECHANICAL SURFACE AERATION, AND BOTH AEROBIC AND ANAEROBIC DIGESTION. STORM OVERFLOWS COULD THEN BE DRAWN OFF AT A CONTROLLED 1.0 MGD RATE TO A MICROSTRAINER. ULTRAVIOLET RADIATION EQUIPMENT FOR ALGAE CONTROL WAS ALSO INSTALLED WITH THE MICROSTRAINER, SO THE TWO COMBINED PROVIDED MECHANICAL FILTRATION, SUSPENDED SOLIDS AND INCIDENTAL BOD REMOVAL, AND ALGAE REMOVAL. BEFORE ENTERING THE SECOND LAKELET, THE EFFLUENT ALSO IS SUBJECTED TO CHLORINE-CHLORINE DIOXIDE DISINFECTION. LAKELET 2 WAS DESIGNED TO PROVIDE CHLORINE CONTACT TIME, NATURAL SURFACE AERATION, AND PHOTOSYNTHETIC OXYGENATION, WHILE LAKELET 3 PROVIDED MECHANICAL AS WELL AS SURFACE AERATION. A PRESSURE SAND FILTER WAS THEN DESIGNED AS A POLISHING STEP. THE ENTIRE TREATMENT SYSTEM WAS INCLUDED AS PART OF AN INNER-CITY PARK. COST OF THIS SYSTEM WAS $7000 PER ACRE BENEFITED, WHEREAS COST OF SEWER SEPARATION ONLY WAS ESTIMATED AT $15,000 PER ACRE. (W72-00042).

REFERENCE LIST

00663. DIRECT DIGITAL CONTROL AT GRAND RAPIDS, MICHIGAN.

CURTIS, J.; EYCK, M.V.
PREPRINT, 44TH ANNUAL CONFERENCE, WATER POLLUTION CONTROL FEDERATION SESSION 2, NO. 3, OCTOBER 3-8, 1971, SAN FRANCISCO, CALIFORNIA. 8 P.

AT CURRENT BOND PRICES, IT IS FINANCIALLY ATTRACTIVE TO SPEND UP TO $100,000 IN CAPITAL COST IN ORDER TO SAVE THE COST OF ONE MAN-SHIFT PER DAY. IF THE PROPOSED 50-25-25 (FEDERAL-STATE-LOCAL) FINANCING OF CAPITAL COST IS ACHIEVED, THE RATIO OF CAPITAL COST PER MAN-SHIFT CHANGES TO $400,000: 1. TO ACHIEVE THIS REDUCTION IN THE NUMBER OF MAN-SHIFTS A DIRECT DIGITAL CONTROL SYSTEM WAS DESIGNED FOR THE CITY OF GRAND RAPIDS, MICHIGAN, WASTEWATER TREATMENT FACILITIES. THE SYSTEM WOULD PROVIDE BOTH MONITORING AND CONTROL OF THE PLANT. A DUAL CHANNEL TECHNICON AUTO ANALYZER, A PERKIN ELMER ATOMIC ABSORPTION SPECTROPHOTOMETER, AND A PRECISION SCIENTIFIC COD ANALYZER WERE SELECTED FOR MONITORING OF THE WASTE STREAM, AND THEY WILL INPUT DIRECTLY TO THE MAIN COMPUTER FOR STORAGE OF THE DATA. CONTROL OVER THE PLANT FUNCTIONS IS ACCOMPLISHED THROUGH FLOW CONTROL AND REDUCTION OF OVERFLOWS FROM STORMS. COST OF THE SYSTEM WAS APPROXIMATELY $800,000, AND THE PLANT WILL TENTATIVELY BE IN FULL OPERATION BY EARLY 1972. (W72-00043)

00664. BIOLOGICAL--GAMMA-RADIATION SYSTEM FOR SEWAGE PROCESSING.

MANN, L.A.
ISOTOPES AND RADIATION TECHNOLOGY, 8(4), 439-444, 1971.

A BIOLOGICAL--GAMMA-RADIATION METHOD FOR PURIFYING SEWAGE WAS DEVELOPED, AND BOTH A PILOT AND COMMERCIAL PLANT WERE DESIGNED, CONSTRUCTED, AND TESTED. THE PLANT DESIGN INCORPORATES SEVERAL MODULES INCLUDING A WET WALL, A BIOLOGICAL TREATMENT UNIT, AN IRRADIATOR, A PRIMARY FILTER SYSTEM, AND AN ACTIVATED-CHARCOAL (POLISHING) FILTER. AT DIFFERENT FLOW RATES ON NORMAL SEWAGE, TESTS INDICATE THAT ALMOST ALL COLIFORM BACTERIA WERE KILLED, AND BOTH BIODEGRADABLE AND NONBIODEGRADABLE DETERGENTS WERE MORE THAN 90% DESTROYED. LIMITED TESTS ON PARATHION IN WATER RESULTED IN 25-30% DESTRUCTION OF THIS INSECTICIDE. THERE IS SOME INDICATION THAT ALGAE WILL NOT GROW IN THE EFFLUENT. FURTHERMORE, SETTLEABLE SOLIDS CONCENTRATION AND TURBIDITY WERE DECREASED, AND A SATISFACTORY BOD LEVEL WAS MAINTAINED IN THE TWO PLANTS. THE COST OF BUILDING AND OPERATING A PLANT USING A BIOLOGICAL--GAMMA-RADIATION SYSTEM DEPENDS ON THE QUALITY OF WATER DESIRED AND THE MODULES SELECTED FOR THE PLANT. ESTIMATES INDICATE THAT THE COST OF TREATMENT PLANTS CONSISTING OF A CONVENTIONAL SECONDARY TREATMENT PLUS IRRADIATOR AND PRIMARY FILTRATION MODULES IS LESS THAN THE COST OF CONVENTIONAL ADVANCED-TREATMENT PLANTS. (W72-00383)

00665. APPLICATIONS OF PROGRAM BUDGETING TO ENVIRONMENTAL PROBLEMS.

HALDI, J.
SOCIAL SCIENCIES AND THE ENVIRONMENT, CONFERENCE ON THE PRESENT AND POTENTIAL CONTRIBUTION OF THE SOCIAL SCIENCES, JANUARY 31-FEBRUARY 2, 1967. UNIVERSITY OF COLORADO PRESS, P 195-210.

THE PLANNING-PROGRAMMING-BUDGETING (PPB) SYSTEM IS DISCUSSED BY FIRST GIVING AN OVERVIEW OF THE SYSTEM AND THEN BY APPLYING IT TO ENVIRONMENTAL PROBLEMS. PPB CONCEIVES OF BUDGETING BY PROGRAMS RATHER THAN BY OBJECT CLASSES, I. E., PERSONNEL, PROCUREMENT, TRAVEL, ETC. IT HAS TWO BASIC COMPONENTS: (1) DEFINITION OF A PROGRAM STRUCTURE AND MAINTENANCE OF A MULTI-YEAR PROGRAM AND FINANCIAL PLAN, AND (2) ANALYSIS, EVALUATION, REVIEW, AND DECISION MAKING ON MAJOR PROGRAM ISSUES. WHEN APPLYING PPB TO ENVIRONMENTAL PROBLEMS, DEFINITION OF OBJECTIVES IS AN EXTREMELY IMPORTANT PROCEDURE. TOO FREQUENTLY THE ANALYSIS NEEDED FOR SUCH DEFINITION IS NON-EXISTENT. THE AUTHOR CONCLUDES THAT A SYSTEM OF COMPARATIVE COST-BENEFIT ANALYSIS, SUCH AS THAT PROVIDED BY PPB, COULD PROVIDE THE KIND OF ANALYSIS THAT IS NEEDED TO MAKE THE BEST KIND OF JUDGMENTS IN DECISION MAKING. COMPARATIVE COST-BENEFIT ANALYSIS, OR COST-EFFECTIVE ANALYSIS, WOULD: (1) COMPARE PROGRAMS THAT AIM AT SIMILAR ENDS, (2) WOULD GIVE A RANK OF EFFECTIVENESS TO EACH PROGRAM, AND (3) WOULD COMPARE DIFFERENT MIXES OF PROGRAMS. SUCH A SYSTEM WOULD LEAD TO TREMENDOUS IMPROVEMENTS IN ENVIRONMENTAL PROGRAMS. (W72-00391)

00666. CONTROLLING POLLUTION: THE ECONOMICS OF A CLEANER AMERICA.

GOLDMAN, M.I.
PRENTICE-HALL, INC., ENGLEWOOD CLIFFS, NEW JERSEY, (1967). 175 P.

A SERIES OF ARTICLES EXAMINES THE SOCIAL COSTS AMERICANS MUST EXPEND IN ORDER TO CONTROL PRESENT SOURCES OF WATER AND AIR POLLUTION AND TO ABATE FUTURE SOURCES. THE TASK AHEAD TO CONTROL POLLUTION IS EXPLAINED AND SOLUTIONS ARE SUGGESTED ON AN INTRA-AND-INTERSTATE LEVEL. THE BOOK IS DIVIDED INTO FIVE TOPICS: (1) PART ONE EXAMINES BOTH THE GENERAL NATURE OF THE PROBLEM AND THE SPECIAL PROBLEMS OF THE GREAT LAKES; (2) PART TWO IS AN ECONOMIC ANALYSIS OF THE COST OF CONTROLLING POLLUTION BY USING SEVERAL ECONOMIC INDICATORS, PRIMARILY THE COST-BENEFIT ANALYSIS; (3) CURRENT CASES ARE ANALYZED TO DEMONSTRATE RECENT EFFORTS IN CONTROLLING AND ABATING WATER POLLUTION IN INTERSTATE RIVERS THROUGH DISPOSAL CONTROL AND TREATMENT OF MUNICIPAL AND INDUSTRIAL WASTES, THE PRIMARY SOURCES OF WATER POLLUTION; (4) PART FOUR PROVIDES A BRIEF LOOK AT SOVIET EFFORTS TO CONTROL WATER POLLUTION; AND (5) EXCERPTS ARE SET FORTH FROM THE ANNUAL REPORT OF THE COUNCIL OF ECONOMIC ADVISORS, 1966, A POLICY STATEMENT FOR THE ABATEMENT OF POLLUTION. (W72-00459)

00667. INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT.

FALKNER, C.H.; STOREY, G.G.; DAVID, E.L.; QUIGLEY, J.T.; MACCORMICK, A.
WISCONSIN WATER RESOURCES CENTER, MADISON, 1970. 356 P.

THIS VOLUME PRESENTS THE RESULTS OF SIX STUDIES TO ANALYZE THE VARIATIONS IN WASTE REDUCTION REQUIREMENTS ALONG A 180-MILE REACH OF THE WISCONSIN RIVER. THE VARIATION OF WASTE REDUCTION REQUIREMENTS IS STUDIED AS A FUNCTION OF SPECIFIED

MINIMUM CONCENTRATIONS OF DISSOLVED OXYGEN, LEVELS OF WASTE DISCHARGE BY VARIOUS SOURCES, THE DESIGNATION OF VARIOUS USES FOR SPECIFIED SUBREACHES OF THE RIVER, THE RISK THAT DISSOLVED OXYGEN STANDARD WILL BE CONTRAVENED, A PRIORI POLICIES SUCH AS PRIMARY TREATMENT PLUS CHLORINATION OR SECONDARY TREATMENT FOR ALL MUNICIPALITIES, PRIOR PROCESS CHANGES FOR SEVERAL INDUSTRIAL SOURCES, TURBINE AND MECHANICAL AERATION, AND PLANS FOR REDISTRIBUTION OF WASTE DISCHARGE POINTS. THE TRADE-OFFS BETWEEN FLOW AUGMENTATION, WASTE REDUCTION, RECREATION, AND POWER ARE EXAMINED. IT IS CONCLUDED THAT A MINIMUM COST WASTE REDUCTION PLAN DEPENDS CRITICALLY ON THE ASSUMED BASES, AND THUS IT IS NECESSARY FOR THE WATER QUALITY MANAGEMENT AGENCY TO CAREFULLY ANALYZE THE EFFECT OF THESE ASSUMPTIONS. (PB-204 579) (W72-01486).

00668. SEWERAGE AUTHORITY SOLVES THE CREDIT CRUNCH.

MARTIN, W.
PUBLIC WORKS, 101(1), 74-75, 1970.

AMONG THOSE WHO HAVE BEEN HARDEST HIT BY THE RECENT RISE IN INTEREST RATES ON MUNICIPAL BONDS ARE SEWERAGE AUTHORITIES. THE PENNSVILLE SEWERAGE AUTHORITY IN SALEM COUNTY, NEW JERSEY, WAS FACED WITH A SITUATION WHERE EXTENSIONS OF THE EXISTING COLLECTION SYSTEM WERE REQUIRED BUT THE TOTAL COST FOR THE IMPROVEMENTS WERE BEYOND THE MEANS OF THE AUTHORITY DUE TO THE GREATLY INCREASED INTEREST RATES. THE SUPERINTENDENT OF THE AUTHORITY, HOWARD, H. JOHNSON, PROPOSED TO DO THE WORK 'IN-HOUSE' ON A PIECEMEAL BASIS USING CURRENT REVENUES. A LIMITED, INITIAL PROJECT WAS APPROVED AS A TRIAL OF THE CONCEPT. OVER 3,800 FEET OF 4, 6, AND 8 INCH SEWER LINES WERE LAID AT A TOTAL COST OF $21,005 OR $6.63 PER FOOT. THIS IS APPROXIMATELY 1/3 TO 1/2 OF THE ESTIMATED COSTS, HAD THE WORK BEEN CONTRACTED OUT WITH MONEY RAISED BY A BOND ISSUE. RECEIPTS FROM THE SERVICES PROVIDED BY THESE IMPROVEMENTS SHOULD PAY FOR THE COSTS IN 4-5 YEARS. THE AUTHORITY HAS MADE PLANS TO COMPLETE THE REQUIRED EXTENSIONS OVER A PERIOD OF 7 1/2 YEARS USING GENERAL REVENUE TO FINANCE THE WORK AS IT IS DONE. IT SHOULD BE MADE CLEAR THAT SUCH A PROCEDURE CAN BE USED ONLY WHEN THE TALENT IS AVAILABLE AND WILLING TO DO THIS SORT OF WORK AND WHEN THE WORK TO BE DONE IS WITHIN THE CAPABILITY OF THE TALENT AT HAND. (W72-01502).

00669. DESIGN AND CONSTRUCTION OF A SHALLOW WATER SEDIMENT CORE SAMPLER.

DANIEL, T.C., CHESTERS, G.
ENVIRONMENTAL LETTERS, 1(3), 225-228, 1971.

A SHALLOW WATER CORE SAMPLER WAS CONSTRUCTED FROM PLUMBING MATERIALS AND EXTRUDED PLEXIGLAS TUBING. CONSTRUCTION OF THE SAMPLER IS SIMPLE AND THE TOTAL COST OF MATERIALS IS APPROXIMATELY $35. THE SAMPLER IS CAPABLE OF TAKING CORES AT WATER DEPTHS UP TO 6 M AND BY MODIFICATION AT GREATER DEPTHS. THE TOTAL WEIGHT OF THE SAMPLER IS 12 KG; IT IS EASY TO OPERATE AND CAN BE USED FOR SEDIMENTS RANGING FROM SAND TO HIGHLY ORGANIC CLAYEY MATERIAL. CORE SAMPLES VARYING IN LENGTH AND CROSS-SECTIONAL AREA CAN BE OBTAINED BY CHANGING THE DIMENSIONS OF THE PLEXIGLAS TUBE. (W72-01738).

00670. IMPROVING MUNICIPAL WATER SUPPLIES IN COLORADO BY DESALTING.

AGARDY, F.J.; DAUBERT, H.
OFFICE OF SALINE WATER RESEARCH AND DEVELOPMENT PROGRESS REPORT NO. 702, JUNE 1971. 114 P.

THIS IS A PRELIMINARY ENGINEERING AND ECONOMIC ASSESSMENT OF THE FEASIBILITY AND COST OF APPLYING VARIOUS DESALTING TECHNIQUES TO IMPROVE THE QUALITY OF COMMUNITY WATER SUPPLIES IN THE HIGH PLAINS REGION OF COLORADO. SIX COLORADO COMMUNITIES, VIZ. BRIGHTON, FT. LUPTON, FT. MORGAN, LA JUNTA, LAS ANIMAS, AND LAMAR, WERE SELECTED BY THE COLORADO WATER CONSERVATION BOARD AS THE CANDIDATES FOR ASSESSMENT. IT WAS FOUND THAT SEVERAL DESALTING METHODS ARE TECHNICALLY FEASIBLE FOR USE AT EACH COMMUNITY TO CORRECT WATER QUALITY DEFICIENCIES. A PREREQUISITE TO FINAL DETERMINATION OF THE SPECIFIC PROCESS THAT WOULD BEST SERVE EACH COMMUNITY WOULD BE THE PERFORMANCE OF A MORE RIGOROUS ENGINEERING ANALYSIS, THE DEVELOPMENT OF ENGINEERED PLANS, AND THE PROCUREMENT OF ESTIMATES FROM REPUTABLE DESALTING PLANT VENDORS. ON A BATTERY LIMITS BASIS, THE WATER QUALITY IMPROVEMENT COSTS AS DEVELOPED IN THIS STUDY RANGE FROM A LOW OF 37 CENTS PER 1000 GALLONS FOR SUPPLYING 2.6 MGD TO FT. MORGAN TO A HIGH OF 57 CENTS PER 1000 GALLONS FOR SUPPLYING 1.4 MGD TO LAS ANIMAS. THE ADDED COSTS OF FEEDWATER SUPPLY, PRODUCT WATER DISTRIBUTION AND BRINE DISPOSAL ARE INCLUDED. (GPO $1.00) (W72-01839).

00671. WATER QUALITY STUDY, REPORT 4, WASTEWATER TREATMENT PROCESSES AND CONCEPTUAL PLAN.

COASTAL BEND REGIONAL PLANNING COMMISSION, CORPUS CHRISTI, TEX. 1971. 129 P.

A COMPREHENSIVE WASTEWATER COLLECTION AND TREATMENT SYSTEM FOR THE COASTAL BEND AREA UNTIL 1990 WAS DEVELOPED. THE DEVELOPMENT CONSISTED OF THREE STAGES, THE FIRST OF WHICH WAS A REVIEW OF CURRENT WASTEWATER TREATMENT METHODS FOR PRIMARY, SECONDARY, DISINFECTION, AND TERTIARY TREATMENT. THE ADVANTAGES AND DISADVANTAGES OF EACH PROCESS WERE LISTED AND EVALUATED TO DETERMINE THEIR APPLICABILITY TO SPECIFIC INSTALLATIONS. A CONCEPTUAL PLAN WAS THEN DEVELOPED TO ACCOUNT FOR ALL AREAS IN BOTH COLLECTION AND TREATMENT OF THE WASTES PRODUCED. THE CONCEPTUAL PLAN WAS DEVELOPED ON A COUNTY BY COUNTY BASIS, AND THE RESULTS ARE SO PRESENTED. FACILITIES WERE DESIGNED FOR ESTIMATED 1990 WASTEWATER PRODUCTIONS, ACCOUNTING FOR INDUSTRIAL, AGRICULTURAL, AND MUNICIPAL EXPANSION. A SUMMARY WAS THEN MADE OF THE OVERALL PLAN INCLUDING THE TIMETABLES FOR EACH ADDITION AND INSTALLATION. COSTS FOR EACH COUNTY WERE COMPUTED INDIVIDUALLY. FOR THE 12 COUNTY AREA, TOTAL COST WAS ESTIMATED AT $43,761,000. (PB-201 202) (W72-02393).

00672. THE USE OF PILOT PLANT STUDIES IN THE DESIGN OF A MAJOR WASTEWATER TREATMENT PLANT.

SAMWORTH, R.B.; BETHEL, J.S.
PREPRINT, PRESENTED AT 44TH ANNUAL CONFERENCE OF WATER POLLUTION CONTROL

TEMS FOR AD-

FEDERATION, SESSION 26, NO 5, OCT 7, 1971. 14 P.

PILOT PLANT STUDIES WERE CONDUCTED TO PROVIDE DESIGN AND COST DATA FOR A WASTE TREATMENT PLANT TO BE LOCATED AT WASHINGTON, D. C., TO MEET NEWLY ADOPTED WATER QUALITY OBJECTIVES FOR THE POTOMAC RIVER. THREE MAJOR SYSTEMS WERE PILOTED AND ALTERNATIVES WITHIN EACH SYSTEM EVALUATED TO SEEK OPTIMUM PROCESS CONFIGURATION COMPARING BOTH PERFORMANCE AND COST. THE SYSTEMS WERE: (1) INDEPENDENT PHYSICAL-CHEMICAL SYSTEM WITH TWO-STATE LIME PRECIPITATION FOR ORGANIC AND PHOSPHORUS REMOVAL, FOLLOWED BY FILTRATION AND ACTIVATED CARBON FOR FURTHER ORGANIC AND PHOSPHORUS REMOVAL, AND ION EXCHANGE, AIR STRIPPING, OR BREAKPOINT CHLORINATION FOR NITROGEN REMOVAL; (2) CONVENTIONAL TERTIARY TREATMENT WITH CONVENTIONAL PRIMARY AND SECONDARY BIOLOGICAL TREATMENT FOLLOWED BY SINGLE OR TWO-STAGE LIME PRECIPITATION FOR PHOSPHORUS REMOVAL, AND FILTRATION AND ION EXCHANGE, AIR STRIPPING, OR BREAKPOINT CHLORINATION FOR NITROGEN REMOVAL. ALTERNATIVES EVALUATED DIFFERED IN METHOD OF ACHIEVING BIOLOGICAL SECONDARY TREATMENT; AND (3) BIOCHEMICAL TREATMENT COMBINING PRIMARY AND SECONDARY TREATMENT WITH BIOLOGICAL NITRIFICATION-DENITRIFICATION FOR NITROGEN REMOVAL FOLLOWED BY FILTRATION. PHOSPHORUS REMOVAL WAS BY EITHER CHEMICAL PRECIPITATION WITH METAL SALTS WITHIN THE SECONDARY, OR SEPARATE LIME PRECIPITATION FOLLOWING DENITRIFICATION. ALL SYSTEMS COULD MEET THE EFFLUENT OBJECTIVES, BUT COST COMPARISONS FAVORED A MODIFIED AERATION, BIOLOGICAL NITRIFICATION-DENITRIFICATION, AND FILTRATION WITH TWO-POINT ALUM ADDITION FOR PHOSPHORUS REMOVAL. (W72-02394).

00673. FINANCING OF MUNICIPAL FACILITIES TREATING INDUSTRIAL WASTES.

PALANGE, R.C.; DILDINE, E.D.
PREPRINT, PRESENTED AT 44TH ANNUAL CONFERENCE OF THE WATER POLLUTION CONTROL FEDERATION, SAN FRANCISCO, OCTOBER 6, 1971. SESSION 16, NO 1. 14 P.

THE COST OF MAINTAINING THE ENVIRONMENT MUST BE INCLUDED IN THE COST OF DOING BUSINESS. THE FEDERAL REGULATIONS OF JULY 2, 1970, THROUGH THE PLANNING REQUIREMENT, WILL AVOID INEFFICIENT USE OF PUBLIC FUNDS BY REQUIRING A COORDINATED ATTACK ON WATER POLLUTION BY ALL COMMUNITIES ALONG A WATERWAY BEFORE PUBLIC MONEY MAY BE SPENT ON MUNICIPAL TREATMENT FACILITIES. MUNICIPALITIES, WHICH IN THE PAST HAVE OFFERED FREE SEWAGE TREATMENT TO LOCAL INDUSTRIES, NO LONGER WILL BE ABLE TO DO THIS. THE NEW REGULATION INSISTS THAT MUNICIPALITIES RECOVER INDUSTRY'S FAIR SHARE OF THE TOTAL INITIAL COSTS AS WELL AS A PRO-RATA SHARE OF OPERATIONAL COSTS TO QUALIFY FOR FEDERAL ASSISTANCE. (W72-02399).

00674. THE WAR ON POLLUTION: ECONOMIC AND FINANCIAL IMPACTS.

SIHLER, W.W.; MEIBURG, C.C.
BUSINESS HORIZONS, P 19-30, AUGUST, 1971.

VIEWED OVER THE LONG RUN, EXPENDITURES FOR ENVIRONMENTAL CONTROL MAY BE THE MOST PRODUCTIVE FOR SOCIETY, BUT THEY DON'T FIT INTO THE TRADITIONAL CONCEPT OF INVESTMENT. THEY DO NOT INCREASE OUR CAPACITY TO PRODUCE CONSUMER GOODS IN THE FUTURE. USING A $7-8 BILLION ESTIMATE OF ANNUAL CAPITAL EXPENDITURES FOR POLLUTION CONTROL, IT WAS ESTIMATED THAT GNP MAY FALL FROM ITS PRESENT 3.5-4% YEARLY INCREASE TO A 3.0-3.5% INCREASE PER YEAR. THESE EFFECTS ON GNP COULD BE REDUCED IF FUNDS FOR POLLUTION CONTROL WERE SHIFTED FROM OTHER INVESTMENT AREAS SUCH AS DEFENSE. ALTERNATIVES FOR FINANCING POLLUTION CONTROL INCLUDE (1) DIRECT FEDERAL GRANTS, (2) AUTHORITY FINANCING BY DIRECT FUNDING OR FEDERAL LOAN GUARANTEES AND (3) TAX POLICY CHANGES INCLUDING TAX CREDITS, POLLUTION CHARGES, AND RETIREMENT OF THE FEDERAL DEBT. (W72-02445).

00675. ECONOMIC AND ENVIRONMENTAL IMPACT OF PROPOSED SOUTH CAROLINA TAX CREDIT FOR INDUSTRIAL POLLUTION CONTROL FACILITIES.

STEPP, J.M.
PAPER PRESENTED AT COUNCIL ON WATER POLICIES, WATER RESOURCES RESEARCH INSTITUTE, FEBRUARY 15, 1971, CLEMSON UNIVERSITY, CLEMSON SOUTH CAROLINA, 22 P.

EFFECTS OF A PROPOSED TAX CREDIT ARE EVALUATED IN TERMS OF THE COST TO THE STATE, PROPENSITY FOR POLLUTION ABATEMENT AND INFLUENCE UPON INDUSTRIAL LOCATION. BY SETTING A FIVE-YEAR TIME LIMIT FOR THE COMPLETION OF TAX CREDIT FACILITIES, THIS LAW WOULD SUBSTANTIALLY EXPEDITE POLLUTION ABATEMENT TO OFFICIALLY ACCEPTABLE LEVELS. THE COST TO THE STATE IN TERMS OF REDUCED CORPORATION INCOME TAX REVENUES IS TENTATIVELY ESTIMATED AT A MAXIMUM OF $18 MILLION A YEAR. FACTORS AFFECTING THIS ESTIMATE ARE DISCUSSED IN DETAIL. MANUFACTURING PLANTS WITH SERIOUS AND EXPENSIVE POLLUTION CONTROL PROBLEMS WILL BE ATTRACTED TO LOCATE IN SOUTH CAROLINA AT THE EXPENSE OF FIRMS WITH FEWER PROBLEMS. FEWER LOCATION SITES, DEGRADED ENVIRONMENTAL QUALITY AND INCREASED TAXES OR DECREASED STATE SERVICES NECESSARY TO PAY THE TAX CREDIT SUBSIDY DISCOURAGE LOCATION OF THE LATTER FIRMS. INDUSTRIAL POLLUTION CONTROL EFFORTS OF OTHER STATES ARE DISCUSSED AND COMPARED AND ALTERNATIVE COURSES OF ACTION TO THE TAX CREDIT LAWS ENUMERATED. (W72-02453)

00676. INDUSTRIAL WATER REUSE: FUTURE POLLUTION SOLUTION.

REY, G.; LACY, W.J.; CYWIN, A.
ENVIRONMENTAL SCIENCE AND TECHNOLOGY, VOL 5, P 760-465, 1971.(W72-20454.

00677. WASTE MANAGEMENT SYS VANCED MILITARY BASES.

QASIM, S.R.; DROBNY, N.L., VALENTINE, B.W.
WATER AND SEWAGE WORKS, VOL 118, P R/92-R/100, 1971.

A TOTAL OF 11 DIFFERENT TREATMENT PROCESSES AVAILABLE FROM 19 DIFFERENT MANUFACTURERS MET THE MINIMUM CRITERIA AND WERE INCLUDED IN THE COST-EFFECTIVENESS ANALYSIS. BOTH CONSTRUCTION AND OPERATING COSTS WERE INCLUDED IN THE ANALYSIS. DATA USED WAS THAT SUPPLIED BY THE MANUFACTURERS. THE ENTIRE SELECTION PROCESS IS PRESENTED ALONG WITH EVALUATIONS FROM EACH SEGMENT. BASED UPON THIS ANALYSIS, THE FIVE MOST COST-EFFECTIVE SYSTEMS FOR INSTALLATION AND USE AT THE AD

VANCED MILITARY BASES ARE: (1) OXIDATION PONDS; (2) AERATED LAGOONS USING A PLASTIC-LINED EARTHEN BASIN; (3) A CHEMICAL PRECIPITATION SYSTEM; (4) A ROTATING BIOLOGICAL CONTACTOR; AND (5) A MODIFIED TRICKLING FILTER WITH FORCED VENTILATION (W72-02663)

00678. THE OUTLOOK FOR WATER.

WOLLMAN, N.; BONEM, G.W.
JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND, 1971.

THIS BOOK PRESENTS A MODEL OF WATER QUALITY CONTROL AND ITS ECONOMIC IMPACTS. THE BASIC MODEL IS BASED ON A 2 PERCENT CHANCE OF FLOW DEFICIENCY, AN ANNUAL FACTOR OF 0.0425, AND AN INSTREAM QUALITY STANDARD OF 4 MG/L OF DISSOLVED OXYGEN. THIS REPORT EXAMINES THE EFFECT OF CHANGING ONE OR MORE OF THESE PARAMETERS, WHILE THE UNDERLYING ECONOMIC CONDITIONS ARE KEPT UNCHANGED. THE COSTS OF EXISTING STORAGE, RECIRCULATION, AND COLLECTION (SEWERAGE) ARE INVARIANT. THEREFORE, 'TOTAL COSTS' REFER TO COSTS OF TREATMENT (BOD) PLUS NEW STORAGE, UNLESS IT IS OTHERWISE INDICATED. SINGLE VARIATIONS OF THE PARAMETERS OF CHANCE OF DEFICIENCY, THE ANNUAL FACTOR, AND DISSOLVED OXYGEN ARE DISCUSSED AND EVALUATED. THREE SPECIFIED COMBINATIONS (REFERRED TO AS 'PROGRAMS') OF FLOW AND STORAGE ARE ANALYZED IN THIS STUDY: (1) THE PROGRAM THAT MINIMIZES STORAGE (REQUIRED FLOW), (2) THE PROGRAM THAT MINIMIZES LEVEL OF TREATMENT, AND (3) THE PROGRAM THAT MINIMIZES THE COMBINED COST OF NEW STORAGE AND TREATMENT. THE TWENTY TABLES IN THE REPORT PROVIDE FIGURES AND PROJECTIONS GAINED FROM APPLICATION OF THE BASIC MODEL TO THE FOLLOWING AREAS OF CONCERN FOR WATER MANAGEMENT: REQUIRED STORAGE, MINIMUM TREATMENT PROGRAM, LEVEL OF TREATMENT, EXPENDITURES FOR QUALITY STANDARDS AND FLOW REGULARITY, REGIONAL SHORTAGES AND AGGREGATE GROSS DEFICITS, AND REGIONAL VARIATIONS IN COST--ALL IMPLICATIONS DERIVED FROM THE BASIC MODEL. (W72-02608).

00679. MECHANICAL AERATION SYSTEMS FOR RIVERS AND PONDS.

HOGAN, W.T.; REED, F.E.; STARBIRD, A.W.
ENVIRONMENTAL PROTECTION AGENCY, WATER POLLUTION CONTROL RESEARCH SERIES, NOVEMBER 1970. 134 P.

THE TOTAL ANNUAL COST OF PROVIDING SUPPLEMENTAL AERATION OF STREAMS AND LAKES BY TESTED AND UNTESTED AERATION EQUIPMENT IS ESTIMATED. ANALYTICAL AND EMPIRICAL EQUATIONS ARE PRESENTED FOR THE DETERMINATION OF OPERATING CHARACTERISTICS OF THE VARIOUS DEVICES USED TO AERATE NATURAL BODIES OF WATER. FOR THE EXAMPLE STREAM EVALUATED IN THIS STUDY, THE MOST ECONOMICAL MEANS OF ARTIFICIAL AERATION GENERALLY POSSIBLE WAS FOUND TO BE MECHANICAL AERATORS WHICH GENERATE A HIGHLY TURBULENT WHITE-WATER SURFACE. FOR THE EXAMPLE LAKE EVALUATED, THE MOST ECONOMICAL TECHNIQUE FOR THE CONTINUAL INPUT OF OXYGEN INTO A LAKE WAS FOUND TO BE DIFFUSED AERATION USING AIR BUBBLES; WHEREAS THE MOST ECONOMICAL TECHNIQUE FOR RAPID INPUT OF OXYGEN, OPERATING ONLY WHILE THE LAKE IS BEING DESTRATIFIED, WAS FOUND TO BE A HYBRID SYSTEM CONSISTING OF A LARGE DIAMETER DUCTED PROPELLER WHICH DRAWS WATER FROM THE LAKE BOTTOM AND DISCHARGES IT AT THE SURFACE WHERE IT IS AERATED BY A MECHANICAL AERATOR. (PB-206 218) (W72-03781).

00680. VIRUS CONTROL AT THE SANTEE, CALIF., PROJECT.

MERRELL, J.C.; WARD, P.C.
JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 60(2), 145-453, 1968.

SINCE 1961 THE SANTEE COUNTY WATER DISTRICT HAS SUPPLIED RECLAIMED WATER FOR USE IN RECREATIONAL LAKES AND AS A SOURCE OF RAW WATER FOR A FLOW-THROUGH SWIMMING BASIN. PROGRAMS FOR THE CONTROL OF VIRUS CONTAMINATION HAVE BEEN EFFECTIVE; THE MOST EFFICIENT BACTERICIDAL AND VERICIDAL TREATMENT WAS PROVIDED BY THE OXIDATION POND AND PERCOLATION ZONE. THESE UNITS CANNOT BE BYPASSED IN THE CHAIN OF TREATMENT, THUS PROVIDING SAFETY. THE WATERS SUPPLIED TO THE SWIMMING AREA WERE FURTHER TREATED BY COAGULATION, FILTRATION, AND HEAVY CHLORINATION; NO VIRUS WAS FOUND NOR ANY EPIDEMIOLOGICAL EVIDENCE OF ILLNESS. NO VIRUS WAS FOUND IN THE RECREATION LAKE WATERS, WHICH DID NOT RECEIVE THESE TREATMENTS. EXCEPTIONAL DEGREE OF EXPERIENCE AND TRAINING NECESSARY FOR LABORATORY PERSONNEL IS NOTED, ALSO THE HIGH COSTS OF PROCESSING SAMPLES (MORE THAN $200 EACH), AND THE NEED FOR A FURTHER STEP FOR CONTROL, NAMELY QUANTITATION OF THE VIRUSES. (W72-04002).

00681. WATER RESOURCES POLICY IN WISCONSIN: GENERAL SUPPORTING STUDIES, VOLUME II.

FAIT, R.G.
WISCONSIN WATER RESOURCES CENTER, MADISON, PARTIAL COMPLETION REPORT, 1971. 139 P.

INFORMATION RELATING TO THE TECHNOLOGY AND COSTS OF NUTRIENT REMOVAL IS SCATTERED AND LIMITED. A BROAD RECAPITULATION OF CURRENT PRIMARY, SECONDARY, AND TERTIARY PROCESSES FOR PHOSPHORUS CONTROL IS PRESENTED. AN EXTENSIVE REVIEW OF THE LITERATURE IS CARRIED OUT TO ESTABLISH THE RANGE AND COSTS OF REMOVAL POSSIBILITIES. ALTERNATIVE PHOSPHORUS REMOVAL DECISIONS ARE SUBSEQUENTLY DEVELOPED FOR EXISTING FACILITIES IN THE WISCONSIN PORTION OF THE LAKE MICHIGAN DRAINAGE BASIN. THE SURVEYED LITERATURE INFORMATION IS AUGMENTED BY AN INVESTIGATION OF LOCAL CHARACTERISTICS TO DETERMINE DISCRETE REMOVAL POSSIBILITIES AND ASSOCIATED AVERAGE COSTS. THE ALTERNATIVE REMOVAL CHOICES SERVE AS INPUT INTO A LEAST-COST, EFFICIENCY MODEL OF PHOSPHORUS REMOVAL POLICIES DEVELOPED IN A SEPARATE STUDY. (PB-206 222) (W72-04079).

00682. ECONOMICS OF WATER SOFTENING.

HOWSON, L.R.
JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 54(2), P 161-166, 1962.

THE GROWTH IN MUNICIPAL WATER SOFTENING IS TRACED, ALSO THE GROWTH IN USE OF HOME SOFTENERS OR RENTAL SOFTENING. COSTS, BENEFITS AND SOME DIFFICULTIES INVOLVED IN BOTH TYPES OF SOFTENING ARE DESCRIBED. IN FOUR MAJOR WISCONSIN CITIES, CONSUMERS SPEND MORE TO INDIVIDUALLY SOFTEN ABOUT 20 PER CENT OF THE WATER THAN THE CITIES COLLECT FOR DEVELOPING, PURIFYING AND DELIVERING ALL OF THE WATER. THESE CITIES COULD SOFTEN THEIR ENTIRE SUPPLIES AT A COST CONSIDERABLY LOWER THAN THAT NOW SPENT TO SOFTEN A SMALL PERCENTAGE. MUNICIPAL SOFTENING OF HARD WATER IS ECONOMICAL AND IN THE CONSUMER'S INTEREST AND IT SHOULD BE PART OF A GOOD WATER SUPPLY SERVICE. GENERALLY, WHERE THE HARDNESS OF THE PUBLIC WATER SUPPLY EXCEEDS 250 PPM, MORE THAN 50 PERCENT OF THE CONSUMERS HAVE INDIVIDUAL SOFTENERS. (W72-04096).

00683. DETERGENTS: A STATUS REPORT.

SUB-COUNCIL REPORT MARCH 1971. 16 P.

THE USE OF THE MOST PROMISING SUBSTITUTE FOR PHOSPHATES IN DETERGENTS, NITRILOTRIACETIC ACID (NTA), HAS BEEN SUSPENDED PENDING FURTHER STUDY AT THE REQUEST OF THE U S SURGEON GENERAL AND THE ENVIRONMENTAL PROTECTION AGENCY. THE SEARCH FOR PHOSPHATE SUBSTITUTES CONTINUES. EUTROPHICATION IS DEFINED AS SIMPLY THE OVERABUNDANCE OF A NATURAL AND NECESSARY PROCESS--TROUBLESOME INDEED WHEN IT OCCURS, BUT, BY NO STRETCH OF THE IMAGINATION, A FORM OF WATER POLLUTION. THERE IS NO EVIDENCE WHATEVER THAT THE REMOVAL OF PHOSPHATES FROM DETERGENTS WILL STOP ACCELERATED EUTROPHICATION. ADEQUATE TECHNOLOGY EXISTS TO REMOVE PHOSPHORUS FROM SEWAGE BY MEANS OF CHEMICAL TREATMENT. FOR RELATIVELY MODEST COSTS, CHEMICAL SEWAGE TREATMENT PERMITS THE REMOVAL OF PHOSPHORUS FROM ALL SOURCES WITHOUT THE CAPITAL COST OF SECONDARY OR TERTIARY SEWAGE PLANTS AND IT IS HIGHLY FLEXIBLE, IN THAT IT CAN BE EMPLOYED IN ONLY THOSE LOCALITIES WHERE CULTURAL EUTROPHICATION IS A PROBLEM. (COM-71-50084) (W72-04266).

00684. REMOVAL OF ORGANIC CONTAMINANTS BY GRANULAR-CARBON FILTRATION.

HAGER, D.G.; FLENTJE, M.E.
JOURNAL OF AMERICAN WATER WORKS ASSOCIATION, 57(11), 1440-1450, 1965.

CARBON FILTRATION IS AN EFFECTIVE PROCESS FOR REMOVING DETERGENTS, INSECTICIDES, VIRUSES, SPECIFIC CHEMICAL POLLUTANTS, AND TASTE AND ODOR POLLUTANTS. GRANULAR-CARBON BEDS ARE MORE EFFICIENT THAN PULVERIZED CARBON USED WITH CONVENTIONAL PLANT PROCEDURES. THIS ADVANTAGE COMPENSATES FOR THE COST DIFFERENTIAL OF THE CARBONS. ADSORPTION AND REMOVAL EXPERIENCES WITH THE VARIOUS POLLUTANTS ARE DISCUSSED, ALSO FILTRATION-ADSORPTION, CHLORINE ADSORPTION, AND DESIGN CRITERIA FOR GRANULAR-CARBON BEDS. FURNACE EQUIPMENT WILL REACTIVATE GRANULAR-CARBON AT A COST OF 2.7 CENTS PER POUND. EXPENDITURE FOR SUCH EQUIPMENT WOULD BE ABOUT $50,000. INVESTMENT AND OPERATING COSTS FOR AN AVERAGE 10 MGD PLANT ARE REVIEWED. (W72-04276).

00685. SOME SOLUTIONS TO SLUDGE TREATMENT PROBLEMS AT FISHMOOR TREATMENT PLANT.

BROWN, A.; LEIGHTON, J.
PAPER PRESENTED AT FISHMOOR TREATMENT PLANT, ENGLAND, AUGUST 10, 1966. 15 P.

DESIGN AND COST DATA ARE PRESENTED FOR THE FILTER PRESSING, FREEZING, POLYELECTROLYTE CONDITIONING, AND LAGOONING OF CLARIFICATION SLUDGE. THE SLUDGE DEWATERING FACILITIES INCLUDE SLOW STIRRING THICKENERS, SLUDGE RETENTION BUNKERS, AND FREEZING TANKS. SLUDGE SOLIDS CONCENTRATIONS AND QUANTITIES ARE LISTED. OPERATIONAL DIFFICULTIES ARE DISCUSSED. THE THICKENER DID NOT FUNCTION ADEQUATELY. THE THICKENER WAS MODIFIED AND TESTING WAS INIATED WITH A DAVY PAXMAN VACUUM FILTER, WALMSLEYS LTD. ROTOKLENE STRAINER, FILTER PRESS, AND POLYELECTROLYTE SLUDGE CONDITIONING AGENTS. DESIGN, OPERATION, AND CONSTRUCTION DETAILS OF A POLYELECTROLYTE CONDITIONING SYSTEM ARE PRESENTED. DESIGN PARAMETERS AND OPERATION EXPERIENCE ARE DISCUSSED FOR THE FILTER PRESS. LENGTHY CONSTRUCTION CONSIDERATIONS ARE ENUMERATED FOR THE FREEZING TANK DESIGN. THE FREEZING CYCLE TIME IS RELATED TO SLUDGE VOLUME, REFRIGERATION AREA, AND FREEZING EFFICIENCY. CAPITAL, OPERATING AND MAINTENANCE, POWER, AND CHEMICAL COSTS ARE PRESENTED FOR THE MAJOR PROCESSES EMPLOYED. (W72-04414).

00686. ECONOMIC AND INSTITUTIONAL ANALYSIS OF WASTEWATER RECLAMATION AND REUSE PROJECTS.

BANKS, H.O.; INERFIELD, A.J., WOLFE, C.G.; TUCKER, D.L.; HARRIS, P.G.
OWRR C-1912 (NO. 3177) (1), 171P, DEC 1971.

METHODOLOGY WAS DEVELOPED FOR SELECTING THE OPTIMUM SIZE, CONFIGURATION, AND TIMING OF A WASTEWATER RECLAMATION PROJECT JOINTLY UNDERTAKEN BY A WASTE DISPOSAL AND WATER SUPPLY AGENCY. THE PROCEDURE IS ALSO APPLICABLE TO RECLAMATION PROJECTS UNDERTAKEN BY A SINGLE AGENCY HAVING BOTH WASTE DISPOSAL AND WATER SUPPLY FUNCTIONS. A SEPARATE PROCEDURE WAS DEVELOPED FOR ALLOCATING PROJECT COSTS BETWEEN DISPOSAL AND SUPPLY FUNCTIONS, AND, IF THE PROJECT INCLUDES RECREATION, TO THAT FUNCTION AS WELL. THE OPTIMIZATION AND COST ALLOCATION PROCEDURES ARE MOST COMPLETELY DEVELOPED FOR RELIABLE, DIRECT USE RECLAMATION PROJECTS PRODUCING A NONPOTABLE SUPPLY. GUIDELINES ARE INCLUDED FOR ANALYZING INTERRUPTIBLE PROJECTS AND THOSE PRODUCING POTABLE SUPPLIES. SUGGESTIONS ARE ALSO INCLUDED FOR SUITABLE INSTITUTIONAL ARRANGEMENTS WHICH WOULD BE NECESSARY FOR JOINT RECLAMATION PROJECTS TO OPERATE EFFICIENTLY. A BASIC CONSIDERATION IN THE ANALYSIS OF ECONOMIC FEASIBILITY OF WASTEWATER RECLAMATION PROJECTS MUST BE AN EVALUATION OF THE COSTS BORNE BY CONSUMERS OF INFERIOR QUALITY WATER. THE REPORT DISCUSSES THIS SUBJECT IN DEPTH AND PRESENTS SOME REPRESENTATIVE CONSUMER COST DATA. THE REPORT ALSO DISCUSSES QUANTITY AND QUALITY REQUIREMENTS FOR VARIOUS USES OF RECLAIMED WATER, AND PRESENTS INFORMATION ON THE METHODS, EFFICIENCIES, AND TYPICAL COSTS OF VARIOUS RECLAMATION PROCESSES. AN EXTENSIVE BIBLIOGRAPHY IS INCLUDED. (W72-04420) (PB-206 522).

00687. STRATEGIES FOR CONTROL OF MAN-MADE EUTROPHICATION.

GRUNDY, R.D.
ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 5(12), 1184-1190, 1971.

ON A NATIONAL BASIS, DETERGENTS PROVIDE 30 TO 40 PERCENT OF ALL THE PHOSPHORUS ENTERING THE AQUATIC ENVIRONMENT. HOWEVER, THIS FIGURE IS SHOWN TO VARY ON A REGIONAL BASIS. BECAUSE THERE ARE MANY OTHER SOURCES OF PHOSPHATES, THEIR CONTROL IN DETERGENTS IS NOT IN ITSELF A SUFFICIENT STRATEGY TO CONTROL EUTROPHICATION. ALSO, ANY REGULATION ON PHOSPHATES IN DETERGENTS SHOULD NOT BE UNDERTAKEN WITHOUT CAREFUL CONSIDERATION OF THE PUBLIC HEALTH AND ENVIRONMENTAL IMPLICATIONS OF ALTERNATIVE FORMULATIONS. VALID CONTROL STRATEGIES SHOULD INCLUDE ADVANCED WASTE WATER TREATMENTS, DIVERSION, DILUTION, AND

LAND DISPOSAL. WASTE WATER TREATMENT USING CHEMICAL PRECIPITATION PROCESSES NOT ONLY REMOVES PHOSPHORUS BUT ALSO FACILITATES THE REMOVAL OF BOD, TOXICANTS, AND OTHER NUTRIENTS. ECONOMIC CONSIDERATIONS SHOW THAT 90 PERCENT OF MUNICIPAL WASTE WATER COULD BE TREATED FOR PHOSPHORUS REMOVAL AT LESS COST TO THE CONSUMER THAN THE INCREASED PRODUCT COSTS FOR DETERGENT PHOSPHATE SUBSTITUTES. IT IS ALSO SIGNIFICANT THAT TREATMENT REDUCES TOTAL PHOSPHATE LEVELS WHILE PRODUCT CONTROLS AFFECT DETERGENT PHOSPHATE ALONE. (W72-04734).

00688. RESEARCH ON DRY-TYPE COOLING TOWERS FOR THERMAL ELECTRIC GENERATION: PART 1.

ROSSIE, J.P.; CECIL, E.A.

WATER POLLUTION CONTROL RESEARCH SERIES, NOVEMBER 1970. 321 P.

AN ECONOMIC ANALYSIS IS MADE FOR THE USE OF DRY COOLING TOWERS IN THERMAL POWER PLANTS IN THE UNITED STATES. TWENTY-SEVEN SITES WERE EXAMINED PROVIDING IN EACH CASE CAPITAL AND OPERATING COST FOR NATURAL AND MECHANICAL DRAFT SYSTEMS BOTH FOR FOSSIL AND NUCLEAR PLANTS. SYSTEM OPTIMIZATION WAS BASED ON CAPITAL COST, AUXILIARY POWER COST, COST DUE TO LOSS OF CAPACITY, AND FUEL COST. COMPARISON WAS MADE WITH WET COOLING TOWER SYSTEMS. WITH ALL FACTORS CONSIDERED, DRY TOWERS WOULD BE ECONOMICALLY COMPETITIVE WITH WET COOLING TOWER SYSTEMS. (PB-206 954) (W72-04829).

00689. AN INTEGRAL APPROACH TO URBAN WATER SUPPLY SYSTEMS.

MOZES, D.

THE ANNALS OF REGIONAL SCIENCE, 3(1), 115-124, 1969.

NEW TECHNOLOGIES FOR DESALTING SEA WATER, SEWAGE TREATMENT, AND RECLAMATION ARE BEING DEVELOPED, AS THE COSTS OF BOTH WATER SUPPLY AND SEWAGE DISPOAL RISE. WITH THE ECONOMY OF SCALE, THE COST OF DESALINATION AND RECLAMATION IS EXPECTED TO REACH A LEVEL OF ECONOMIC FEASIBILITY. AN INTEGRATED APPROACH IS NEEDED, EVALUATING THE NEW POSSIBILITIES IN WATER SUPPLY, SEWAGE DISPOSAL, RECLAMATION, AND DESALINATION TO PRODUCE AN OPTIMAL SOLUTION TO WATER SUPPLY AND SEWAGE DISPOSAL OF URBAN AREAS. LONG RANGE PLANNING FOR URBAN WATER SUPPLY AND SEWAGE DISPOSAL WITH THE INCREMENTAL COST OF INDEPENDENT SOLUTIONS TO WATER SUPPLY AND SEWAGE DISPOSAL SYSTEMS MUST BE CONSIDERED TOGETHER. AN ECONOMIC EVALUATION MUST COMPARE THE INCREMENTAL COST OF INDEPENDENT SOLUTIONS TO WATER SUPPLY AND SEWAGE DISPOSAL WITH THE INCREMENTAL COST OF INCORPORATING THE TWO SYSTEMS. IT MUST FURTHER COMPARE THE INCREMENTAL COST OF INTRODUCING DESALTING UNDER THE ALTERNATIVE OF SEA WATER DESALTING RECLAMATION BLENDING AND RECYCLING OF RECLAIMED WATER. FREQUENTLY, INTEGRAL SOLUTIONS CAN BE ECONOMICALLY SUPERIOR TO THE TRADITIONAL METHODS OF SUPPLYING ADDITIONAL WATER AND SATISFACTORY DISPOSAL OF SEWAGE. FACTORS INCLUDE: THE INCREASING COSTS OF WATER SUPPLY, THE INCREASING COSTS OF SEWAGE DISPOSAL, THE ECONOMIC FEASIBILITY OF NEW TECHNOLOGIES IN RECLAMATION AND DESALTING, THE OPEN ALTERNATIVES FOR URBAN WATER SUPPLY SYSTEMS, AND SOME OF THE EFFECTS OF AN INTEGRAL WATER SUPPLY SEWAGE DISPOSAL SYSTEM. (W72-05565).

00690. ENVIRONMENTAL QUALITY: THE SECOND ANNUAL REPORT OF THE COUNCIL ON ENVIRONMENTAL QUALITY, AUGUST 1971.

COUNCIL ON ENVIRONMENTAL QUALITY, WASHINGTON, D.C. 360 P. 1971.

THIS REPORT DESCRIBES THE STATE OF THE ENVIRONMENT AND THE EFFORTS TO IMPROVE IT. IT REVIEWS MANY OF THE DEVELOPMENTS IN THE AREA OF ENVIRONMENTAL QUALITY WHICH HAVE OCCURRED DURING THE PAST YEAR ON THE INDIVIDUAL, LOCAL, STATE, FEDERAL, AND INTERNATIONAL LEVELS. IT ALSO DESCRIBES BOTH THE STATUS AND TRENDS IN THIS AREA AND DISCUSSES A NUMBER OF ENVIRONMENTAL PROBLEMS PRESENT IN THE INNER CITY. A COMPREHENSIVE EXAMINATION OF TWO FUNDAMENTAL ASPECTS OF ENVIRONMENTAL QUALITY IS INCLUDED. THE FIRST OF THESE ASPECTS IS ECONOMICS: (1) THE DAMAGES CAUSED BY POLLUTION, (2) THE COSTS AND BENEFITS OF POLLUTION CONTROL, (3) THE PARTICULAR IMPACTS OF COSTS ON THE ECONOMY, AND (4) THE STRATEGIES AVAILABLE BOTH FOR ATTAINING ENVIRONMENTAL GOALS AND DEALING WITH ECONOMIC ADJUSTMENTS. THE SECOND ASPECT EXAMINED IS THE LAW AND THE ENVIRONMENT, ON BOTH THE FEDERAL AND THE STATE LEVELS, INCLUDING: (1) THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 AND ITS EFFECTS, (2) LEGAL TECHNIQUES IN FEDERAL POLLUTION CONTROL; (3) CITIZEN CHECKS ON AGENCY ACTIONS AFFECTING THE ENVIRONMENT, SUCH AS THE CITIZEN'S RIGHT TO KNOW ABOUT, PARTICIPATE IN, AND CHALLENGE SUCH ACTIONS; AND (4) SPECIFIC DEVELOPMENTS IN STATE LAW. (GPO $2.00) (W72-05520).

00691. AN ECONOMIC ANALYSIS OF POULTRY PROCESSING WASTEWATER IN DELAWARE.

HUDSON, B.L.; COLE, G.L.; SMITH, R.C.

AGRICULTURAL EXPERIMENT STATION, BULLETIN 383, DECEMBER 1970. 18 P.

THE AMOUNT OF WASTE AND WASTEWATER CREATED BY DELAWARE'S POULTRY PROCESSING PLANTS IS ENORMOUS: MAIN EFFLUENT VOLUMES RANGE FROM ONE-QUARTER TO ONE-HALF MILLION GALLONS PER DAY PER PLANT. THE UNRECOVERED WASTE REPRESENTS A COST SINCE WASTE TREATMENT MUST BE PROVIDED IN ACCORDANCE WITH GOVERNMENT REGULATIONS TO PREVENT OR ABATE POLLUTION OF DELAWARE'S WATERWAYS. AVERAGE MAIN EFFLUENT VOLUMES PER PROCESSED BIRD RANGED FROM 3.2 TO 8.2 GALLONS. THERE SEEMED TO BE SOME ECONOMIES OF SCALE INVOLVED IN REDUCING PER UNIT WASTEWATER VOLUMES SINCE THE WASTE WATER PER BIRD WAS FOUND TO BE INVERSELY RELATED TO KILL RATE AND PLANT SIZE. (W72-05659).

00692. RATE SURCHARGES: FRIEND OR FOE.

DECKER, C.T.

WATER AND WASTES ENGINEERING, 8(11), F-2 TO F-4, 1971.

TIGHTER CONTROLS ON BOTH THE EFFLUENT CRITERIA AND THEIR ENFORCEMENT WILL MEAN A GREATER CAPITAL INVESTMENT BY INDUSTRY WITH A MUNICIPALITY. THESE CONTROLS WILL PLACE MORE SIGNIFICANCE ON THE RATE SURCHARGE AS A MEANS FOR REIMBURSEMENT OF THE OPERATION AND MAINTENANCE EXPENSES. ALSO, THEY WILL SERVE AS A LIMITING DEVICE ON WHAT INDUSTRY WILL PAY THE MUNICIPALITY TO TREAT AND HANDLE ITS WASTES. ADVANTAGES TO AN INDUSTRY OF GOING TO THE CITY WITH UNTREATED WASTEWATER INCLUDE (1) PASSING THE TREATMENT RESPONSIBILITY ON TO THE CITY; (2) SAVINGS ON CONSTRUCTION COSTS; (3) PASSING THE OPERATION AND MAINTENANCE PROBLEMS

ON TO THE CITY, AND (4) THE POSSIBILITY OF ENHANCING ITS PUBLIC IMAGE AS A SUPPORTER FOR CLEANING UP THE WASTES. POSSIBLE DISADVANTAGES INCLUDE (1) MUNICIPAL TREATMENT PLANTS HAVE TRADITIONALLY BEEN OVERDESIGNED AND EXPENSIVELY OVERBUILT; (2) THE DISTANCE BETWEEN THE COMPANY AND THE CITY MAY REQUIRE MANY MILES OF SEWERS; AND (3) THE MUNICIPAL SEWERAGE COMMISSION MAY RAISE THE RATE SURCHARGE AT ANY TIME. THE MEANS OF REIMBURSEMENT FOR A SANITARY DISTRICT INCLUDE (1) AD VALOREM TAXES, (2) PERCENTAGE OF WATER BILL TAX, (3) SPECIAL ASSESSMENT CHARGES, (4) VOLUME OF SEWAGE CHARGES, (5) 'READY TO SERVE' CHARGES, AND (6) VOLUME PLUS A RATE SURCHARGE FOR BOD, SUSPENDED SOLIDS, AND OTHER SPECIAL CONSTITUENTS. (W72-05663).

00693. BENEFITS OF WATER QUALITY ENHANCEMENT.

ENVIRONMENTAL PROTECTION AGENCY, WATER QUALITY OFFICE, WATER POLLUTION CONTROL RESEARCH SERIES, DECEMBER 1970. 201 P.

THE THREE FOLLOWING AREAS PERTAINING TO WATER QUALITY AND POLLUTION CONTROL ARE CONSIDERED: (1) THE DEVELOPMENT OF A POLLUTION INDEX FOR BENEFIT ANALYSIS, (2) MEASUREMENTS OF THE TOTAL DOLLAR BENEFIT OF WATER POLLUTION CONTROL, AND (3) BENEFITS OF WATER QUALITY ENHANCEMENT. A POLLUTION INDEX IS DEVELOPED FOR SPECIFIC WATER USES WHEN SUCH MULTIPLE ITEMS OF WATER QUALITY AS BOD OR DO ARE INVOLVED. THE INDEX IS SPECIFIC FOR ONE OF THREE WATER USES, (1) HUMAN CONTACT, (2) INDRECT CONTACT, AND (3) REMOTE CONTACT. THESE THREE SPECIFIC INDICES MAY BE COMBINED INTO AN OVERALL POLLUTION INDEX. THE DOLLAR BENEFIT OF A WATERWAY AT A GIVEN QUALITY LEVEL IS DETERMINED BY LISTING ALL USES WHICH BOTH AFFECT AND ARE AFFECTED BY WATER QUALITY, BY VALUING EACH USE INDIVIDUALLY, AND BY SUMMING THE RESULTANT VALUES. MEASURABLE BENEFICIAL WATER USES INCLUDE RECREATION, WASTEWATER DISPOSAL, WITHDRAWAL WATER USES, BORDERING LAND USES, AND IN-STREAM USES. FINALLY, THE STUDY SUGGESTS THAT WATER POLLUTION ABATEMENT PROGRAMS CAN BE ADMINISTERED MOST EFFICIENTLY AT THE REGIONAL RATHER THAN STATE OR FEDERAL LEVEL. EFFICIENCY CONSIDERATIONS ALSO IMPLY THAT THE REGIONAL AGENCIES SHOULD SELL THE POLLUTION-CARRYING CAPACITY OF WATER BASED ON BENEFITS FOREGONE DUE TO POLLUTION. (PB-207 358) (W72-05666).

00694. AN ANALYSIS OF THE ECONOMIC IMPLICATIONS OF THE PERMIT SYSTEM OF WATER ALLOCATION.

HARL, N.E.; BALDWIN, R.A.; HUBLY, D.W.
IOWA WATER RESOURCES RESEARCH INSTITUTE, AMES, COMPLETION REPORT ISWRRI-43, NOVEMBER 1971. 261 P.

THE LITERATURE OF WATER ALLOCATION IS REVIEWED AND THE PERMIT SYSTEM OF ADMINISTRATIVE ALLOCATION IS ANALYZED IN TERMS OF RATIONAL GUIDELINES FOR ALLOCATING WATER AS A SCARCE RESOURCE AMONG COMPETING ALTERNATIVES. SPECIAL ATTENTION WAS GIVEN TO THE IOWA PERMIT SYSTEM, WITH THE CONCLUSION THAT THE SYSTEM ACKNOWLEDGES ONLY TWO CONSISTENTLY IDENTIFIED POINTS ON A WATER USER'S PRODUCTION FUNCTION (1) THE POINT OF ZERO OUTPUT AND ZERO WATER USE, AND (2) THE POINT OF MAXIMUM TOTAL PRODUCT WHERE THE MARGINAL PHYSICAL PRODUCT BECOMES ZERO. THE SYSTEM GUIDELINES ARE INSUFFICIENT FOR ALLOCATING WATER ON EFFICIENCY BASES IF SUPPLY IS LIMITED AND MAXIMUM PHYSICAL PRODUCTIVITY FROM WATER AS A VARIABLE INPUT IS UNATTAINABLE. IN AN EFFORT TO GENERATE INFORMATION ABOUT WATER PRODUCTIVITIES, TO THE END THAT ADDITIONAL POINTS ON THE PRODUCTION FUNCTION MIGHT BE IDENTIFIED ADMINISTRATIVELY AS PERMITS ARE GRANTED UNDER CONDITIONS OF LIMITED WATER SUPPLY IN A PARTICULAR AREA, A GENERAL MODEL IS CONSTRUCTED IN PART II USING A LINEAR PROGRAMMING APPROACH TO RESOURCE ALLOCATION WITHIN AN IDENTIFIED HYDROLOGIC AREA. (PB-207 476) (W72-05839).

00695. THE ECONOMICS OF POLLUTION.

UPTON, C.
SELECTED PAPERS NO. 36, 1970. 11 P.

THERE ARE COSTS OF ELIMINATING POLLUTION AS WELL AS COSTS OF MAINTAINING IT. THE FIRST PROBLEM IS TO CHOOSE THE LEVEL OF POLLUTION THAT BALANCES THE COSTS OF POLLUTING AGAINST THE COSTS OF NOT POLLUTING. THE SECOND PROBLEM IS TO DEFINE STANDARDS OF ACCEPTABLE LEVELS OF POLLUTION. ALL RECENT DEBATES ON THE GOAL OF CLEAN AIR AND WATER HAVE IGNORED THE PROBLEM OF DEFINING CLEAN. ANSWERS TO THE FOLLOWING QUESTIONS ARE DISCUSSED. (1) WHY IS POLLUTION A PROBLEM; (2) HOW SHALL WE ACHIEVE THE DESIRED LEVEL OF POLLUTION; (3) HOW MUCH POLLUTION DO WE WANT. THE UNSUCCESSFUL ALLOCATION OF THE USE OF NATURAL RESOURCES OCCURS BECAUSE THERE IS NO APPROPRIATE PRICING MECHANISM FOR THE RIGHTS TO NATURAL RESOURCES. IN ADDITION, TYPES OF POLLUTION NEED TO BE CLASSIFIED AND THE COSTS OF POLLUTION MEASURED. THE EVENTUAL SOLUTION TO PROBLEMS OF CONTROL IS THE SETTING OF THE STANDARD WHERE THE COST OF A MARGINAL UNIT OF POLLUTION IS EQUAL TO COST OF CLEANING UP THAT UNIT OF POLLUTION. THE LACK OF PROPERTY RIGHT IN THE CASE OF THE USE OF NATURAL RESOURCES SUGGESTS THE NECESSITY OF SOME GOVERNMENTAL INTERVENTION TO SET THE LEVEL OF POLLUTION AT SOME STANDARD AND TO SEE THAT THE STANDARD IS ACHIEVED AND MAINTAINED. THREE POSSIBLE SOLUTIONS TO THE ACHIEVEMENT OF THIS POLLUTION STANDARD ARE CONTROL BY FIAT, CONTROL BY TAXATION, AND CONTROL BY PROPERTY RIGHT. (W72-05934).

00696. DISCUSSION OF THE RECLAMATION OF SEWAGE EFFLUENTS FOR DOMESTIC USE.

PARKHURST, J.D.
PROCEEDINGS, INTERNATIONAL ASSOCIATION ON WATER POLLUTION RESEARCH CONFERENCE, 3RD, MUNICH, GERMANY, 1966, P 27-32.

IN PARALLEL WITH THE DEVELOPMENT OF THE WINDHOEK RECLAMATION SCHEME, A RECLAMATION SCHEME TO PROVIDE RECREATIONAL WATER FOR LANCASTER, CALIFORNIA, HAS BEEN DEVELOPED. THE LANCASTER SYSTEM FEATURES: (1) 60 DAY RETENTION OF PRIMARY EFFLUENT IN OXIDATION PONDS, PERMITTING 50% TOTAL NITROGEN REDUCTION, STABILIZATION OF ORGANICS, AND DIE-OFF OF VIRUSES, PATHOGENS, AND PARASITES; (2) ALUMINUM SULFATE COAGULATION; (3) ALGAE REMOVAL BY EITHER FLOTATION OR SEDIMENTATION; (4) SAND FILTRATION; (5) CHLORINATION AT 15 MG/L DOSAGE AND 12 HOUR CHLORINE CONTACT TIME; AND (6) DISCHARGE TO RECREATIONAL LAKE. AVERAGE EFFLUENT COD OF 41 MG/L OBTAINED WITHOUT CARBON FILTRATION IS COMPARED TO A REPORTED 35 MG/L COD IN THE EFFLUENT AT WINDHOEK AFTER CARBON FILTRATION. COSTS FOR THE LANCASTER FACILITIES HAVE BEEN REPORTED AS 3 CENTS/1000 GALLONS FOR CAPITAL

FACILITIES AND 11.5 CENTS/1000 GALLONS FOR OPERATION AND MAINTENANCE FOR A 3 MGD PLANT. COSTS FOR PRIMARY AND SECONDARY FACILITIES OF THE SAME SIZE WERE REPORTED AS 8.3 CENTS/1000 GALLONS, SO THE SYSTEM COST WOULD BE 22.8 CENTS/1000 GALLONS, COMPARING FAVORABLY TO THE 46.5 CENTS/1000 GALLONS REPORTED AT WINDHOEK. (W72-06019).

00697. PHOSPHATE EXTRACTION PROCESS.

ALBERTSON, O.E.; SHERWOOD, R.J.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 41(8), 1467-1489, 1969.

A COMPLEMENTARY LIQUID AND SLUDGE HANDLING TREATMENT SYSTEM WAS TESTED FOR THE CHEMICAL REMOVAL OF PHOSPHATE AND INCREASED BIOCHEMICAL-OXYGEN DEMAND REMOVAL FOLLOWED BY THE ACTIVATED SLUDGE PROCESS. THE SYSTEM REDUCED PHOSPHATE REMOVAL OPERATING COSTS TO A LEVEL COMPARABLE TO THAT FOR CONVENTIONAL TREATMENT. THE COMBINATION OF LIME MUD WITH WASTEWATER SLUDGE WAS PRACTICAL. THE SYSTEM, TOO, IS ABLE TO AFFECT AMMONIA NITROGEN REMOVAL WITH THE SAME BASIC APPROACH, ALTHOUGH COSTS ARE GREATER. AN ADDITIONAL BENEFIT WAS THE ELIMINATION OF SULFIDE ODORS IN THE PRIMARY PORTION OF THE PLANT. (W72-06110).

00698. ARSENIC REMOVAL FROM POTABLE WATER.

BELLACK, E.
JOURNAL OF AMERICAN WATER WORKS ASSOCIATION, 63(7), 454-458, 1971.(W72-06198.

CHEMICAL COSTS FOR SIMULTANEOUSLY REMOVING FLORIDE AND ARSENIC FROM WATER ARE $15-$50/MILLION GAL..

00699. COSTS OF TREATING TEXTILE WASTES IN INDUSTRIAL AND MUNICIPAL TREATMENT PLANTS: SIX CASE STUDIES.

SOUTH CAROLINA WATER RESOURCE INSTITUTE, CLEMSON, REPORT NO. 27, MARCH 1972, 64P.

DATA ON OPERATIONS AND COSTS OF MANUFACTURING AS WELL AS WASTEWATER TREATMENT WERE OBTAINED FROM 6 TEXTILE MILLS WHICH EMPLOYED 9,150 WORKERS AND TREATED APPROXIMATELY 5.9 BILLION GALLONS OF WASTEWATER IN 1968, AND ON THE OPERATIONS OF 26 MUNICIPAL SEWAGE PLANTS WHICH IN 1967 TREATED THE LIQUID WASTES OF 98 TEXTILE MILLS. ELEVEN OF THE MUNICIPALITIES PROVIDED COST DATA THAT WERE COMPARABLE WITH THE DATA OBTAINED FROM THE INDUSTRIAL FIRMS. TREATMENT COSTS PER UNIT OF WASTEWATER WERE QUITE HIGH FOR 2 FIRMS WHICH HAD VERY SMALL VOLUMES OF WASTEWATER, BUT IN NO CASE DID TREATMENT COSTS AMOUNT TO AS MUCH AS ONE PERCENT OF TOTAL MANUFACTURING COSTS. MEASURED IN 1969 PRICES, COSTS OF TREATING TEXTILE WASTES IN 11 MUNICIPAL FACILITIES RANGED FROM 10.05 TO 53.54 CENTS PER 1,000 GALLONS. THE COMPARABLE RANGE IN THE 6 INDUSTRIAL FACILITIES WAS FROM 2.4 CENTS TO $12.28. HOWEVER, THE UNIT COSTS OF 3 OF THE 6 INDUSTRIAL FACILITIES WERE BELOW 10 CENTS PER 1,000 GALLONS, AND THE UNIT COSTS OF ANOTHER WERE LOWER THAN THOSE OF 9 OF THE 11 MUNICIPALITIES USED AS THE BASIS FOR COMPARISON. TECHNICAL AND INSTITUTIONAL PROBLEMS ASSOCIATED WITH TREATMENT OF INDUSTRIAL WASTES IN MUNICIPAL FACILITIES ARE ALSO DISCUSSED. (PB-208 021) (W72-06601).

00700. EFFLUENT TAXES AND REGULATION.

RESOURCES, NO. 39, P. 9-10, JANUARY 1972.

PRESENT GOVERNMENTAL PROGRAMS TO COMBAT ENVIRONMENTAL POLLUTION DEPEND HEAVILY ON ENFORCEMENT ACTION AGAINST INDIVIDUAL POLLUTERS AND SUBSIDIES FOR TREATMENT PLANT CONSTRUCTION. MANY ECONOMISTS FAVOR GREATER RELIANCE ON EFFLUENT CHARGES. THIS WOULD BE MORE EFFICIENT AND EQUITABLE BECAUSE SOCIAL COSTS WOULD BE REFLECTED AND COSTS WOULD BE INTERNAL TO THE POLLUTER. THIS WOULD CREATE AN INCENTIVE TO REDUCE POLLUTION BY ANY MEANS LESS EXPENSIVE THAN THE TAX. IT WOULD ALSO REDUCE CONSUMPTIVE DEMAND THROUGH HIGHER PRICES. UNIFORM REGIONAL RATES WOULD BE NEEDED. INTEGRATED REGIONAL AND RIVER BASIN INSTITUTIONS ARE NEEDED TO REDUCE TREATMENT COSTS THROUGH ECONOMIES OF SCALE. SEVERAL PROMINENT CONSERVATION GROUPS HAVE RECENTLY ANNOUNCED THEIR SUPPORT FOR EFFLUENT CHARGES BECAUSE CURRENT ABATEMENT METHODS ARE INEFFECTIVE. (W72-06884).

00701. RECLAIMING WATER FROM WATER PLANT SLUDGE.

SCOLARI, E.
PUBLIC WORKS, 99(6), P 100, 1968.

THE RECOVERY OF SUPERNATANT FROM SLUDGE DRYING BEDS PRODUCED A TREATED WATER COST SAVINGS. WATER TREATMENT INCLUDED LIME-SODA SOFTENING, CLARIFICATION, RECARBONATION, AND VACUUM TYPE DIATOMITE FILTRATION. SOME SLUDGE IS RECIRCULATED. THE HIGHLY TREATED SLUDGE SUPERNATANT IS RECLAIMED RATHER THAN DISCHARGED TO THE SEWER SYSTEM. AN ASBESTOS-CEMENT LINED PIPE INTERCEPTED DECANTED WATER AND RETURNED IT TO RECEIVING WELLS BY GRAVITY FLOW. PUMPS, AUTOMATICALLY OPERATED BY FLOAT SWITCHES, RETURNED THIS WATER TO THE FLOCCULATING SECTION OF THE TREATMENT FACILITIES. FINAL INSTALLED COSTS WERE LESS THAN $6526. THE FIRST YEAR THE PLANT RECLAIMED 36 MGD OF WATER WITH A TREATED WATER VALUE OF $8394. SECOND YEAR RECOVERY EXCEEDED 43 MGD WITH A TREATED WATER VALUE OF $10,563. (W72-06822).

00702. TWO METHODS OF STUDYING THE EFFECT OF MUNICIPAL SEWER SURCHARGES ON FOOD PROCESSING WASTES.

ETHRIDGE, D.E.; SEAGRAVES, J.A.
ECONOMICS RESEARCH REPORT NO. 18, DECEMBER 1971. 27 P.

WASTE TREATMENT CHARGES TRADITIONALLY HAVE BEEN BASED ON THE VOLUME OF WATER CONSUMED. SURCHARGES BASED ON THE STRENGTH OF INDUSTRIAL WASTES DISCHARGED INTO SEWER SYSTEMS ARE RAPIDLY BECOMING MORE COMMON. ESTIMATES OF THE RESPONSE OF TWO INDUSTRIES TO SEWER SURCHARGES ARE PRESENTED AND TWO DIFFERENT EMPIRICAL PROCEDURES USED TO MAKE SUCH ESTIMATES ARE ILLUSTRATED. A BUDGETING APPROACH WAS USED TO ESTIMATE THE RESPONSES OF SUGAR BEET PROCESSING FIRMS TO SEWER CHARGES BASED ON WASTE STRENGTH. A TYPICAL BEET PROCESSING PLANT COULD PROFITABLY REDUCE ITS WATER CARRIED WASTES BY 75 PERCENT IF FACED WITH A CHARGE OF $. 02 PER POUND OF BOD. REGRESSION ANALYSIS WAS USED TO ESTIMATE THE RESPONSE OF POULTRY PROCESSING FIRMS TO CHARGES BASED ON WASTE STRENGTH. FIRMS HAVE RESPONDED AS ONE WOULD EXPECT TO INCREASES IN SURCHARGES AND

THE PRICE OF WATER -- REDUCING WASTES AND USE OF WATER. (W72e06976).

00703. EVALUATION OF EXTENDED AERATION TREATMENT AT RECREATION AREAS, PROGRESS REPORT.

CLARK, B.D.
WORKING PAPER NO 68, REPORT NO PR-8, MARCH 1970. 90 P.

IT IS RECOMMENDED THAT, WHERE SECONDARY TREATMENT IS THE DESIRED STANDARD, THE USE OF EXTENDED AERATION ACTIVATED SLUDGE SYSTEMS FOR THE TREATMENT OF RECREATION WASTES BE DISCOURAGED UNLESS ADEQUATE ASSURANCE CAN BE GIVEN THAT THE PLANT WILL BE PROPERLY OPERATED AND MAINTAINED, INCLUDING PROPER SLUDGE WASTING FACILITIES, AND/OR AN ADEQUATELY DESIGNED SOLIDS REMOVAL PROCESS IS ADDED TO THE SYSTEM EITHER IN THE FORM OF A POLISHING POND OR A FILTRATION UNIT. (PB-208 436) (W72-07248).

00704. HOUSEBOAT WASTES: METHODS FOR COLLECTION AND TREATMENT.

CLARK, B.D.
FWPCA PROGRAM 15020---06/67. JUNE 1967. 84 P.

PUMPING ALL WASTES TO A SHORE SEWER IS THE LEAST EXPENSIVE AND MOST PRACTICAL ALTERNATIVE WHEREVER THIS IS POSSIBLE. AEROBIC BIOLOGICAL TREATMENT UNITS WITH DISINFECTION FACILITIES WOULD PROVIDE SATISFACTORY TREATMENT; COSTS FOR A FLOATING UNIT WOULD RANGE FROM $1800 TO TREAT THE WASTES FROM A SINGLE HOUSEBOAT, TO $200 PER HOUSEBOAT FOR THE WASTES FROM 50 HOUSEBOATS. PRIMARY SETTLING WITH SLUDGE REMOVAL FACILITIES AND CHLORINATION OF THE EFFLUENT COULD BE CONSIDERED AS AN INTERIM METHOD OF TREATMENT. A SYSTEM ADEQUATE TO SERVE UP TO 25 TO 35 HOUSEBOATS COULD BE FABRICATED FOR $500 TO $700, EXCLUDING LABOR COSTS. A SYSTEM DESIGN WITH THREE ALTERNATIVES WAS MADE FOR A TYPICAL MOORAGE IN THE PORTLAND, OREGON, AREA. THE DESIGN CONSIDERED: (1) PUMPING WITH CENTRIFUGAL PUMPS DIRECTLY TO A CITY SEWER, (2) PUMPING WITH CENTRIFUGAL PUMPS DIRECTLY TO A CITY SEWER FROM EACH HOUSEBOAT, AND (3) PUMPING WITH PNEUMATIC EJECTORS TO A FLOATING TREATMENT FACILITY. THE COST TO THE INDIVIDUAL HOUSEBOAT OWNER FOR EACH PLAN WAS $935, $1560, AND $1460, RESPECTIVELY. THE FIRST COST TO THE MOORAGE OWNER FOR EACH PLAN WAS $7500, $4600, AND $8700, RESPECTIVELY. THESE FIGURES DO NOT INCLUDE ANNUAL COSTS FOR FINANCING, OPERATION, AND MAINTENANCE. (PB-208 439) (W72-07251).

00705. ECONOMIC ANALYSIS OF ALTERNATIVE WATER POLLUTION CONTROL MEASURES.

BARNARD, J.R.; LOFGREEN, H.A.
IOWA STATE WATER RESOURCES RESEARCH INSTITUTE, AMES, COMPLETION REPORT ISWRRI-42, DECEMBER 1971. 19 P.

THE POTENTIAL COST OF COMMITMENTS TO WATER QUALITY IS EXPLORED AS WELL AS WAYS IN WHICH THAT COST MIGHT BE MINIMIZED WITHIN FEDERAL AND STATE GOVERNMENT GUIDELINES OF IMPROVED WATER QUALITY. COST ESTIMATES OF CONTROLLING INDUSTRIAL AND MUNICIPAL POLLUTION ARE DEVELOPED FROM ENGINEERING SOURCES FOR A NUMBER OF TREATMENT SEQUENCES WHICH ARE USED AS PROXIES FOR VARYING LEVELS OF WATER QUALITY. ESTIMATES OF COSTS OF CAPITAL FACILITIES, OPERATING COSTS, AND AVERAGE COSTS ARE MADE FOR THE UNITED STATES AND IOWA. THE EMPHASIS IS ON THE ESTIMATION OF THE POTENTIAL BURDEN OF WATER QUALITY DECISIONS AS WELL AS EXPLORING WAYS IN WHICH THAT BURDEN MAY BE MINIMIZED. IT IS ESTIMATED THAT IT WOULD REQUIRE AN EXPENDITURE OF ABOUT $8 BILLION IN NEW CAPITAL FACILITIES FOR WASTEWATER TREATMENT FOR THE URBAN POPULATION IN THE UNITED STATES, AND NEARLY $15 BILLION FOR AN EXTENSIVE INDUSTRIAL WASTEWATER TREATMENT PROGRAM. THE ESTIMATED AGGREGATE ANNUAL AVERAGE COST FOR 1968 IS $4,519 MILLION, OR ABOUT $22.50 PER CAPITA. (PB-208 611) (W72-07362).

00706. ECONOMICS OF WATER QUALITY MANAGEMENT: EXEMPLIFIED BY SPECIFIED POLLUTANTS IN AGRICULTURAL RUNOFF.

JACOBS, J.J.
PH.D. THESIS, 1972. 208 P.

SEDIMENT AND PHOSPHORUS IN AGRICULTURAL RUNOFF WERE THE POLLUTANTS SELECTED IN DEPICTING THE ROLE OF ECONOMICS IN WATER QUALITY MANAGEMENT. THE AGRICULTURAL LAND IN THE NISHNABOTNA RIVER BASIN IN SOUTHWESTERN IOWA WAS THE STUDY AREA. THIS LAND WAS SPLIT UP ACCORDING TO SIX CAPABILITY CLASSES, SUPPLIED BY THE CONSERVATION NEEDS INVENTORY. THESE CAPABILITY CLASSES IN COMBINATION WITH CROP ROTATIONS TILLAGE METHODS AND CONSERVATION PRACTICES ARE REGARDED AS A CROPPING SYSTEM. FOR EACH SYSTEM THE ANNUAL COSTS AND RETURNS IN ADDITION TO SEDIMENT AND PHOSPHORUS LOSSES WERE ESTIMATED. WITH THIS INFORMATION THE MINIMUM COST OF ACHIEVING SPECIFIED LEVELS OF WATER QUALITY, I. E., SEDIMENT AND PHOSPHORUS, WAS OBTAINED. THE STUDY RESULTS POINT UP THE DOMINANCE OF MINIMUM TILLAGE AND CONTINUOUS ROW CROPS IN THE OPTIMAL SOLUTIONS. THE RESULTS ALSO INDICATE THAT THE MAGNITUDE OF THE DELIVERY RATIO AND THE PHOSPHORUS CONSTRAINTS HAVE A RELATIVELY SMALL IMPACT ON THE COST OF THE PROGRAM. FURTHERMORE, IT WAS SHOWN THAT THE MOST STRINGENT CONSTRAINT COULD BE MET AT AN ESTIMATED COST OF ABOUT $4.75 PER ACRE WITH A DELIVERY RATIO OF . 25. WHILE THIS COST DOES NOT APPEAR TO BE UNREASONABLE, COMPARING THE CONTROL COST WITH THE BENEFITS TO A MUNICIPAL USE INDICATES THAT THIS LEVEL OF QUALITY CONTROL CAN ONLY BE JUSTIFIED ECONOMICALLY IF THERE IS A LARGE REUSE OF THE WATER (80-400: 1) OR SUBSTANTIAL AESTHETIC BENEFITS. (W72-07365).

00707. SEWER MAINTENANCE COSTS.

SANTRY, I.W. JR.
PREPRINT, PRESENTED AT 44TH ANNUAL CONFERENCE OF WATER POLLUTION CONTROL FEDERATION. SESSION 15, NO. 1, SAN FRANCISCO, CALIFORNIA, OCTOBER 6, 1971. 30 P.

DESIGN OF RECORD-KEEPING OPERATIONS FOR SANITARY AND STORM SEWERS IS AN INTEGRAL PART OF MUNICIPAL PUBLIC WORKS, REGARDLESS OF WHETHER OR NOT A COMPUTER IS USED. SUFFICIENT INFORMATION REGARDING LENGTH OF SERVICE, COST OF MAINTENANCE, EASE OF REPAIR, AND OTHER PARAMETERS MUST BE ACQUIRED FOR EACH STRETCH OF SEWER LINE IN ORDER TO FORM RATIONAL DECISIONS FOR REPAIR OR REPLACEMENT, AND TO EVALUATE THE MATERIALS AND WORKMANSHIP OF PREVIOUS INSTALLATIONS. ANALYSIS OF THE DATA REVIEWED SHOWED THAT REPAIRS ON BOTH MAINS AND BUILDING SERVICE LINES BY A MUNICIPALITY REFLECT

ABOUT THE SAME PERCENTAGES FOR LABOR, MATERIALS, EQUIPMENT AND ADMINISTRATION. CLEANING AND PERIODIC ISPECTION COSTS MUST ALSO BE ACCOUNTED FOR IN ANY COMPREHENSIVE COST ANALYSIS. INCLUSION OF EACH OF THESE ITEMS IN DETAIL, AS WELL AS ANY OTHER PERTINENT INFORMATION IN AN AVAILABLE BODY OF DATA, WILL PROVIDE MANAGEMENT WITH A RATIONAL BASIS FOR BOTH BUDGETARY AND OPERATIONAL DECISION MAKING. (W72-07805)

00708. AN ECONOMIC ANALYSIS OF EROSION AND SEDIMENT CONTROL FOR WATERSHEDS UNDERGOING URBANIZATION.

BRANDT, G.H.; CONYERS, E.S.; LOWES, F.J.; MIGHTON, J.W.; POLLACK, J.W.
OWRR C-1677 FINAL REPORT, 1972. 181 P.

ECONOMIC BENEFITS ARE EXPECTED FROM CONTROLLING EROSION AND SEDIMENT DURING URBAN CONSTRUCTION, BUT CONTROL COSTS HAVE NOT BEEN PREVIOUSLY RELATED TO BENEFITS. THIS STUDY RELATES COST TO EFFECTIVENESS AND DAMAGE VALUES FOR MANY EROSION AND SEDIMENT CONTROL SYSTEMS. THE SENECA CREEK WATERSHED, NEAR WASHINGTON, D. C., WAS USED AS A MODEL. ESTIMATED MAXIMUM SOIL EROSIAN RATES APPROACH 200 TON/ACRE/YEAR OR 128,000 TON/SQ. MILE/YEAR. SEDIMENT DAMAGES FROM SUCH UNCONTROLLED EROSION ON URBAN CONSTRUCTION SITES IN THE SENECA WATERSHED COULD POTENTIALLY REACH $1,500/ACRE. PRESENT CONTROL PRACTICE INCLUDES SEDIMENT BASINS, DIVERSION BEAMS, LEVEL SPREADERS, GRADE STABILIZATION STRUCTURES, SODDED DITCHES, SEEDING AND STRAW MULCH TACKED WITH ASPHALT OR DISKED. THE AVERAGE CONVENTIONAL SYSTEM IS ESTIMATED TO COST $1,125/ACRE AND TO CONTROL 91% OF THE POTENTIAL EROSION. CONTROL SYSTEMS INCORPORATING LARGE SEDIMENT BASINS CAN BOOST CONTROL TO 96% AT LESS TOTAL COST. MULTIPURPOSE IMPOUNDMENTS DESIGNED WITH SEDIMENT FOREBAYS FOR CHEMICAL FLOCCULATION CAN BOOST URBAN SEDIMENT CONTROL TO 99%, AND, IN ADDITION, CONTRIBUTE SIGNIFICANTLY TO CONTROLLING SEDIMENT FROM OTHER LAND. (PB-209 212) (W72-08246)

00709. EQUITABLE SHARING OF MUNICIPAL WASTE TREATMENT COSTS--TECHNICAL CONSIDERATIONS.

BALDEN, A.R.
PREPRINT, PRESENTED AT 44TH ANNUAL CONFERENCE OF WATER POLLUTION CONTROL FEDERATION, SESSION 16, NO. 2, OCTOBER 6, 1971, SAN FRANCISCO, CALIFORNIA., 6 P.

CURRENT LEGISLATION PROVIDES FINANCIAL ASSISTANCE TO SMALL MUNICIPALITIES WHO WISH TO BUILD WASTEWATER TREATMENT PLANTS, BUT CANNOT AFFORD THEM. HOWEVER, INDUSTRIES ARE NOT ELIGIBLE FOR SUCH ASSISTANCE, AND SINCE IT IS A WELL-RECOGNIZED FACT THAT LARGER, MORE CENTRALIZED FACILITIES ARE USUALLY MORE ECONOMICAL THAN EACH INDUSTRY HAVING ITS OWN TREATMENT PLANT, SOME FORMULA IS NEEDED FOR CHARGING THE INDUSTRIES FOR TREATMENT OF THEIR WASTES IN A MUNICIPAL FACILITY. THE ENVIRONMENTAL PROTECTION AGENCY HAS DEVELOPED SUCH A FORMULA. DIRECT SUPERVISION AND ENFORCEMENT OF THE FORMULA SHOULD REVERT TO THE STATE, WITH THE WITHDRAWAL OF ALL FEDERAL REGULATORY PERSONNEL, EXCEPT WHEN REQUESTED TO ASSIST. THIS WOULD ELIMINATE THE MULTIPLICITY OF EFFORT AND ITS ASSOCIATED PYRAMIDING COSTS. (W72-08361)

00710. SPLIT TREATMENT LIME SOFTENING REDUCES OPERATING COSTS AT AMES, IOWA.

ROSKOPH, R.; CLEASBY, J.L.
WATER AND SEWAGE WORKS, 114(12), 477-480, 1967.

AT AMES, IOWA, THE DESIRED WATER QUALITY OF 85 PPM TOTAL HARDNESS, 35 PPM TOTAL ALKALINITY WAS PRODUCED BY SPLIT TREATMENT. A STABLE EFFLUENT WAS PRODUCED AND NO HARDNESS WAS REMOVED ON THE FILTERS, IN CONTRAST TO REMOVAL OF 15 TO 30 PPM WITH CONVENTIONAL AND TWO-STAGE SOFTENING. FILTER RUNS WERE TRIPLED WITH A SAVINGS IN BACKWASH WATERS. ABOUT 25 PERCENT BY-PASSING WAS FOUND DESIRABLE. ADDING SOME SODA ASH TO THE SECOND STAGE PERMITTED A SMALL REDUCTION IN REQUIRED LIME FEED. VALUE OF HIGH SLUDGE CONCENTRATION (BY USE OF RETURN SLUDGE) IN THE SOFTENING REACTION ZONE WAS CONFIRMED. A MIXTURE OF FIRST- AND SECOND-STAGE SLUDGE WAS RETURNED TO THE SECOND-STAGE SOFTENING, ALSO SOME TO THE FIRST STAGE. THE SPLIT-TREATMENT SINGLE-STAGE COMPARISON AT AMES INDICATED THAT SPLIT-TREATMENT REQUIRED 10 PPM LESS LIME, 6 PPM LESS SODA ASH, 4.29 CU. FT. /1000 GAL LESS NATURAL GAS (NONE USED WITH SPLIT TREATMENT), AND LESS BACKWASH WATER OR ABOUT 15 PERCENT REDUCTION IN CHEMICAL COSTS, AND PRODUCED 20 PPM SOFTER WATER THAN THE SINGLE STAGE SOFTENING PROCESS. (W72-08873)

00711. USE OF GENERAL EQUILIBRIUM IN REGIONAL WATER RESOURCE PLANNING.

ENVIRONMENTAL PROTECTION AGENCY WATER POLLUTION CONTROL RESEARCH SERIES, JANUARY, 1972. 162 P.

GENERAL EQUILIBRIUM ANALYSIS IS SHOWN TO BE A FEASIBLE TOOL FOR ESTIMATING THE OPTIMAL LEVEL OF PUBLIC GOODS IN A REGIONAL ECONOMY AND THE OPTIMAL ALLOCATION OF PUBLIC FUNDS TO OBTAIN THE DESIRED LEVEL. THIS ANALYSIS PROVIDES A METHODOLOGY FOR INVESTIGATING THE EXTERNALITIES ASSOCIATED WITH VARIOUS FORMS OF PRODUCTION. AN INTERACTION OR TRADE MECHANISM IS PRESENTED WHICH WILL FORCE A REGIONAL ECONOMY INTO EQUILIBRIUM WITH THE ECONOMY IN WHICH IT IS EMBEDDED; RELATIVE PRICES WILL BE IDENTICAL IN THESE ECONOMIES FOR THEIR COMMON COMMODITIES. A TECHNIQUE IS PRESENTED BY WHICH ALL PUBLIC GOODS CAN BE TREATED IN A GENERAL EQUILIBRIUM FRAMEWORK. THE RESULTS OF SOME NUMERIC COMPUTATIONS INDICATE HOW THE METHODOLOGY WORKS WITH A REGIONAL ECONOMY WHICH HAS A PUBLIC GOOD. SINCE ONE OF THE CONCLUSIONS FROM A GENERAL EQUILIBRIUM APPLICATION IS THE OPTIMUM SUPPLY OF ANY COMMODITY, THIS TECHNIQUE CAN BE USED TO DETERMINE EFFICIENT AND ECONOMICAL METHODS OF CONTROLLING WATER POLLUTION IN A GIVEN REGION. (PB-209 893) (W72-09228)

00712. POLLUTION: CLEANING UP COSTS MONEY.

GASKELL, P.
ATLANTIC COMMUNITY QUARTERLY, VOL. 10, P 84-93, 1972.

INDUSTRY SPENDS CLOSE TO 10% OF THE COST OF A NEW PLANT ON POLLUTION CONTROL EQUIPMENT. IN EUROPE WHERE INTERNATIONAL TRADE IS COMMON, INDUSTRIES IN NATIONS WITH LESS STRINGENT POLLUTION CONTROLS ARE ABLE TO REDUCE COSTS AND THUS OUTSELL NATIONS WITH HIGHER ENVIRONMENTAL STANDARDS.

ALTHOUGH INTERNATIONAL SOLUTIONS WOULD BE AN IDEAL METHOD OF RESOLVING THIS PROBLEM, INTERNATIONAL ORGANIZATIONS ARE STILL ONLY STUDYING IT. WHETHER POLLUTION CONTROL COSTS SHOULD BE PAID THROUGH TAXES ON POLLUTERS OR INCENTIVES FOR CLEAN INDUSTRIES IS CURRENTLY BEING DEBATED. GERMANY HAS IMPOSED STIFF PENALTIES ON ITS WATER POLLUTERS. HOWEVER, CRITICS OF TAXING EFFLUENTS SAY THIS WILL NOT ENCOURAGE INDUSTRY TO DEVELOP CLEANER PROCESSES. (W72-09461).

00713. FILTRATION OF WATER AND WASTEWATER.

IVES, K.J.
CRC CRITICAL REVIEWS IN ENVIRONMENTAL CONTROL, 2(2), 293-335, 1971.

A REVIEW OF THE RECENT ADVANCEMENTS IN FILTRATION TECHNOLOGY WAS CONDUCTED, DEALING PRIMARILY WITH SLOW SAND FILTERS, RAPID SAND FILTERS, PRECOAT FILTERS, AND MICROSTRAINERS. APPLICATIONS, MODES OF OPERATION, MAINTENANCE REQUIRED, AND COST FIGURES WERE ASSEMBLED FOR EACH TYPE OF FILTER. SOME GENERAL RULES FOR FILTRATION WHICH WERE SELECTED FROM THE TECHNICAL LITERATURE INCLUDE: (1) HEAVY TURBIDITY LOADS CANNOT BE SUSTAINED BY EITHER SLOW SAND OR PRECOAT FILTERS; (2) ALUM FLOC WILL CLOG SLOW SAND FILTERS WHEREAS MICROSTRAINERS WILL NOT RETAIN IT; (3) SLOW SAND AND PRECOAT FILTERS RETAIN FINE TURBIDITY, RAPID SAND FILTERS RETAIN IT IF IT IS PREVIOUSLY FLOCCULATED, AND MICROSTRAINERS CANNOT RETAIN IT; (4) ALL 4 FILTERS RETAIN PLANKTON, ALTHOUGH SMALLER ALGAE ARE NOT RETAINED BY MICROSTRAINERS AND RAPID FILTERS; (5) ONLY MICROSTRAINERS AND RADIAL FLOW RAPID FILTERS OPERATE CONTINUOUSLY; (6) MICROSTRAINER HEADLOSS IS 0.15 M COMPARED TO 1 TO 20 M FOR THE OTHER FILTER TYPES; AND (7) RAPID FILTERS HAVE THE WIDEST APPLICABILITY TO BOTH WATER AND WASTEWATER TREATMENT. COSTS PRESENTED WERE NOT FOR OPTIMUM FILTERS, SINCE TREATMENT SYSTEMS, NOT TREATMENT COMPONENTS, ARE OPTIMIZED. (W72-09393).

00714. COST TO THE CONSUMER FOR COLLECTION AND TREATMENT OF WASTEWATER.

SMITH, R; EILERS, G.
ENVIRONMENTAL PROTECTION AGENCY WATER POLLUTION CONTROL RESEARCH SERIES, 86.

THE NATIONAL AVERAGE PER CAPITA COST FOR COLLECTION AND TREATMENT OF MUNICIPAL WASTEWATER IS COMPUTED BASED ON THE 1968 INVENTORY OF MUNICIPAL WASTE TREATMENT FACILITIES IN THE UNITED STATES AND PER CAPITA COST RELATIONSHIPS FOR BUILDING AND OPERATING COLLECTION AND TREATMENT FACILITIES. ALL COSTS ARE GIVEN PER CAPITA SERVED WITH TREATMENT FACILITIES USING THE LEVEL OF TREATMENT EXISTING IN 1968. TOTAL COST WAS COMPUTED AS $19.80 PER CAPITA PER YEAR. OF THIS TOTAL, $15.31 REPRESENTS AMORTIZATION CHARGES AND $4.40 REPRESENTS CURRENT CHARGES. THE TOTAL COST CAN ALSO BE BROKEN DOWN AS $13.34 FOR COLLECTION, $4.38 FOR TREATMENT AND $2.08 FOR OVERHEAD SUCH AS CUSTOMER SERVICES, ADMINISTRATIVE, AND GENERAL. THE COST OF COLLECTION IS, THEREFORE, ABOUT THREE TIMES AS EXPENSIVE AS TREATMENT. NATIONALLY, ABOUT 23% OF THE TOTAL COST IS PAID AS SEWERAGE USAGE CHARGES. THIS REPRESENTS ABOUT 0.1% OF NATIONAL PERSONAL CONSUMPTION EXPENDITURES. EXPENDITURE FOR WATER SUPPLY AVERAGED $13.42 PER CAPITA PER YEAR AND THIS IS ABOUT EQUAL TO THE AMOUNT PAID BY THE CONSUMER IN USER CHARGES FOR WATER SUPPLY. THE CURRENT STATUS OF COLLECTION AND TREATMENT IN THE UNITED STATES IS DISCUSSED AND ESTIMATES ARE MADE OF NEEDED ADDITIONAL EXPENDITURE. (PB-210 199) (W72-09826).

00715. ECONOMICS OF WASTE DISPOSAL FROM CONFINED LIVESTOCK.

MORRIS, W.H.M.
LIVESTOCK WASTE MANAGEMENT AND POLLUTION ABATEMENT, PROCEEDINGS INTERNATIONAL SYMPOSIUM ON LIVESTOCK WASTES, OHIO STATE UNIVERSITY, APRIL 19-22, 1971, P 195-196.

THE COSTS OF HANDLING LIVESTOCK WASTES MUST BE CONSIDERED IN THE FRAMEWORK OF THE TOTAL PRODUCTION SYSTEM, AND THIS MAY CHANGE THE LOCATION, VOLUME, CONSISTENCY, AND COMPOSITION OF THE WASTE. FURTHERMORE, SUCH ITEMS AS SLOTTED FLOORS AND OXIDATION DITCHES OFTEN COMPRISE A LARGE PART OF THE TOTAL COST OF A BUILDING . UNDER U. S. CONDITIONS, THE COST OF DISPOSAL OF LIVESTOCK WASTES EXCEEDS THEIR VALUE. NO ONE SYSTEM OF DISPOSAL IS THE LEAST COSTLY OR THE MOST PROFITABLE UNDER ALL CIRCUMSTANCES. FACTORS SUCH AS THE COST OF LABOR AND OF CAPITAL AND AVAILABILITY OF LAND IN DIFFERENT SEASONS DETERMINE THE ECONOMICALLY OPTIMAL SYSTEM. NO PROFITABLE METHOD CAN BE FORESEEN FOR INDUSTRIAL OR DOMESTIC UTILIZATION OF ANY SIGNIFICANT PART OF THE LIVESTOCK WASTE PRODUCED. IT IS EXPECTED THAT THE PRODUCER WILL CONTINUE TO USE THE PRESENTLY AVAILABLE SYSTEMS OF DISPOSAL FOR THE FORESEEABLE FUTURE. SPREADING ON LAND, ANAEROBIC, AND AEROBIC TREATMENT AND FEEDING ALL SEEM PRACTICAL ALTERNATIVES. THE ECONOMIC CHOICE DEPENDS ON THE SPECIES, THE ENVIRONMENT, AND MANY OTHER FACTORS. (W72-09994).

00716. THE ECONOMICS OF SWINE WASTE DISPOSAL.

OKEY, R.W.; BALAKRISHNAN, S.
LIVESTOCK WASTE MANAGEMENT AND POLLUTION ABATEMENT, PROCEEDINGS INTERNATIONAL SYMPOSIUM ON LIVESTOCK WASTES, OHIO STATE UNIVERSITY, APRIL 19-22, 1971, P 199-203.

POSSIBLE TREATMENT METHODS INCLUDE (1) GROUND DISPOSAL, (2) LAGOON STORAGE, (3) TOTAL OXIDATIVE TREATMENT, (4) ORGANIC SOLIDS SEPARATION AND TREATMENT OF THE LIQUID STREAM, (5) PRIMARY TREATMENT PLUS NITROGEN AND/OR PHOSPHORUS REMOVAL AND/OR DISSOLVED SOLIDS REMOVAL. THE COSTS FOR WASTE TREATMENT FOR A 5,000 ANIMAL SWINE SYSTEM RANGED FROM $17,600 FOR A 'SOLIDS SEPARATION PRIOR TO OXIDATIVE CONVERSION OF AMMONIA' SYSTEM TO $35,500 PER YEAR FOR A 'BASIC OXIDATION TREATMENT WITH NITROGEN AND PHOSPHORUS REMOVAL' SYSTEM. IF TOTAL SOLIDS REMOVAL WAS REQUIRED, THE OVERALL MANAGEMENT COSTS OF EITHER SYSTEM WOULD BE INCREASED BY $7,300 BY ADDING A MEMBRANE SYSTEM TO REMOVE ALL THE INORGANICS. IN ADDITION, A SATISFACTORY POINT OF ULTIMATE DISPOSAL MUST BE FOUND FOR THE SOLIDS WHICH WERE SEPARATED OUT. FOR SMALL LIVESTOCK SYSTEMS, THE COST PER UNIT WILL BE INCREASED SLIGHTLY FOR MOST TREATMENTS. (W72-09996).

00717. DISPOSAL OF BEEF MANURE BY DEEP PLOWING.

REDEELL, D.L.; JOHNSON, W.H.; LYERLY, P.J.; HOBGOOD, P.

LIVESTOCK WASTE MANAGEMENT AND POLLUTION ABATEMENT, PROCEEDINGS INTERNATIONAL SYMPOSIUM ON LIVESTOCK WASTES, OHIO STATE UNIVERSITY, APRIL 19-22, 1971, P 235-238.

FOUR TILLAGE TECHNIQUES FOR DEEP PLOWING LARGE QUANTITIES OF MANURE INTO THE SOIL WAS EVALUATED AT EL PASO AND PECOS, TEXAS, DURING THE SUMMER OF 1970. THE SOIL AT EL PASO IS A SANDY LOAM, WITH A SANDY SUBSOIL. THE SOIL AT PECOS IS A SILTY CLAY LOAM. UP TO 900 TONS OF MANURE PER ACRE CAN BE PLOWED UNDER WITH A 30-INCH MOLDBOARD PLOW AT A MINIMUM COST OF 4.5 CENTS PER TON. IN SANDY SOILS, THE DISK PLOW SHOULD BE ABLE TO PLOW UNDER AT LEAST 600 TONS PER ACRE WITH A MINIMUM COST OF 2.1 CENTS PER TON. THE 18-INCH PLOW IS LIMITED TO ABOUT 300 TONS PER ACRE. THE TRENCHER SEEMS MOST VERSATILE FROM THE STANDPOINT OF HIGH RATES AND SOIL PENETRATION DEPTHS. THE COSTS WILL BE HIGH AND IN THE ORDER OF 50 CENTS PER TON AT THE 900 TON LEVEL. THE COMPLETE MIXING OF MANURE AND SOIL AS DONE BY THE TRENCHER IS IMPRESSIVE. AT THIS TIME, THE WATER QUALITY PROGRAM SHOWS NO SERIOUS POLLUTION PROBLEM FOR SURFACE WATER RUNOFF. THE SOIL WATER SAMPLES AT THE 4-FOOT DEPTH INDICATE THAT DENITRIFICATION IS TAKING PLACE. THE MAJOR GROUNDWATER AND SOIL POLLUTION PROBLEM WOULD APPEAR TO BE FROM SODIUM CHLORIDE. (W72-10006).

00718. CONVENTIONAL USE OR REUSE--A COST COMPARISON.

KOENIG, L.

PROCEEDINGS OF THE 16TH ANNUAL CONFERENCE ON WATER FOR TEXAS, 'URBAN WATER RESOURCES PLANNING AND MANAGEMENT', SAN ANTONIO, TEXAS, SEPTEMBER 9-10, 1971, TEXAS WATER RESOURCES INSTITUTE, P 129-152.

THIS STUDY EXPLORES WHAT WOULD HAPPEN AND WHAT WOULD HAVE TO BE DONE IF ALL THE SEWAGE FLOW OF A MUNICIPALITY WAS TREATED TO MAKE IT POTABLE AND IT WAS RECYCLED TO THE DISTRIBUTION SYSTEM. IN PARTICULAR, IT COMPARES THE QUANTITIES AND COSTS OF THIS SCHEME AS AGAINST THE OTHER EXTREMES, NAMELY CONVENTIONAL SUPPLY FROM THE NEXT AVAILABLE SOURCE AND CONVENTIONAL SEWAGE TREATMENT AND DISCHARGE. USING SAN ANTONIO, TEXAS, AS AN EXAMPLE, TWO EXTREME CASES ARE COMPARED: DISCHARGE ALL WATER, RECYCLE NONE AND RECYCLE ALL WATER, DISCHARGE NONE. IN THE RECYCLENG EXAMPLE, A FOUR-STATE ADVANCED WASTE TREATMENT PROCESS WAS CONSIDERED: LIME CLARIFICATION, WITH RECALCINATION, AMMONIA REMOVAL BY CLINOPTILOLITE ION EXCHANGE, ACTIVATED CARBON ABSORPTION AND FINALLY ELECTRODIALYSIS FOR DEMINERALIZATION. REUSE IN THESE FIRST APPROXIMATING COMPUTATIONS PROVES MORE EXPENSIVE THAN CONVENTIONAL SUPPLY FOR SAN ANTONIO, BUT THE SURPRISING THING IS HOW CLOSE IT COMES TO BEING COMPETITIVE, THE DIFFERENCE IN COST BEING ABOUT 10%. (W72-10108).

00719. ECONOMIC EVALUATION OF TYPICAL WATER WORKS TELEMETERING SYSTEMS.

COBB, E.B.; DANEKER, J.; NUSBAUM, W.E.; BARROW, R.; MULLER, G.D.

JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 55(10), 1297-1331, 1963.

REPRESENTATIVES OF VARIOUS WATER SUPPLY SYSTEMS HAVE DEVELOPED ESTIMATES OF COSTS INVOLVED IN ESTABLISHING TELEMETERING DEVICES. INITIAL COSTS COVER THE EQUIPMENT TO MONITOR EACH OF SELECTED FUNCTIONS, INSTALLATION CHARGES, AND NEW TELEPHONE LINES. ANNUAL OPERATING COSTS INVOLVE POWER, RENTAL OF TELEPHONE LINES, EQUIPMENT FAILURES, PREVENTIVE MAINTENANCE ROUTINES, AND A SPARE PARTS INVENTORY. CONSIDERATIONS IN SHIFTING TO TELEMETERING INCLUDE THE ADVANTAGES OF RELIABILITY, BETTER CONTROL, AND FLEXIBILITY, THE REQUIREMENT FOR FEWER PERSONNEL BUT BETTER PAID PERSONNEL, ACCEPTANCE OF A SUPPLIER SERVICE CONSTRACT OR TRAINING A MAINTENANCE TECHNICIAN. ONE PART OF THE DISCUSSION BRIEFLY DESCRIBES TYPES OF TELEMETERING EQUIPMENT. (W72-10378).

00720. ECONOMICS DICTATES FRESH LOOK AT AN ENGINEERING PROBLEM.

TEALE, J.M.

WATER AND WASTES ENGINEERING, 9(3), B-4 B-6, B-14, 1972.

AS THE EXPERIENCE OF ONE VITAMIN MANUFACTURER SUGGESTS, WASTE DISPOSAL IS INFLUENCED BY BOTH ENGINEERING AND ECONOMIC CONSIDERATIONS. ENGINEERING DICTATED THE METHODS BY WHICH THE FIRM COULD DISPOSE OF ITS LIQUID WASTE STREAM CONTAINING 25% METHANOL. THE ENGINEERING SOLUTIONS PROPOSED WERE (1) FRACTIONAL DISTILLATION TO RECOVER A PRODUCT SUITABLE FOR REUSE; (2) FRACTIONAL DISTILLATION TO RECOVER A PRODUCT OF PURITY HIGHER THAN 55% FOR RESALE; (3) FRACTIONAL DISTILLATION AND BURNING IN AN INDUSTRIAL INCINERATOR; (4) FRACTIONAL DISTILLATION TO REDUCE THE COST OF SHIPPING OUT OF THE PLANT; (5) SHIPPING IT OUT OF THE PLANT WITHOUT ANY PRIOR TREATMENT. THE CHOICE BETWEEN THESE ALTERNATIVES WAS MADE BY APPEALING TO ECONOMICS. THE NET COST OF EACH PROPOSAL WAS COMPUTED ON AN ACTUAL COST BASIS AND AN INCREMENTAL COST BASIS. THE REUSE ALTERNATIVE SHOWED A PROFIT UNDER BOTH COST BASES AND WAS, THUS, TANKED FIRST AMONG THE FIVE PROPOSALS. THE SELL ALTERNATIVE SHOWED A PROFIT WITH INCREMENTAL COSTING AND A LOSS WITH ACTUAL COSTING, AND RANKED SECOND UNDER BOTH BASES. THE BURN, DISTILL, AND TRUCKING ALTERNATIVES WERE RANKED FIFTH, FOURTH, AND THIRD, RESPECTIVELY, UNDER ACTUAL COSTING AND FOURTH, THIRD, AND FIFTH, RESPECTIVELY, UNDER INCREMENTAL COSTING. (W72-10421).

00721. ECONOMICS OF WATER QUALITY AND WASTEWATER CONTROL.

CASE, F.E.

JOURNAL OF THE SANITARY ENGINEERING DIVISION, AMERICAN SOCIETY OF CIVIL ENGINEERS, VOL. 98(SA2), 427-434, 1972.

IN THE PAST, WATER WAS TREATED AS A 'FREE' GOOD. HOWEVER, POPULATION INCREASES AND TECHNOLOGICAL CHANGES HAVE INCREASED THE DEMAND FOR WATER TO THE EXTENT THAT IT IS NOW ONE OF OUR SCARCEST NATURAL RESOURCES. AS AN ECONOMIC GOOD, WATER IS VALUABLE IN CREATING OTHER GOODS, AS A NATURAL FORCE FOR PRODUCING ENERGY, OR AS AN AGENT FOR IMPROVING THE QUALITY OF LIVING AND THE ENVIRONMENT. UNFORTUNATELY, THE PRIVATE MARKETPLACE TENDS TO UNDER-PRICE WATER. THE OPTIMIZING INDIVIDUAL OR FIRM USES WATER AND CREATES WASTEWATER WITHOUT REGARD FOR THOSE SOCIAL COSTS NOT INCLUDED IN THE PRICE OF WATER. THIS MARKET FAILURE PROVIDES A RATIONALE FOR PUBLIC INTERVENTION WHICH MAY TAKE SUCH FORMS AS REGULATIONS OR TAX-SUBSIDY SCHEMES. WATER PRODUCTION MUST INCLUDE CONSIDERATION OF WASTEWATER DISPOSAL PROBLEMS SO THAT PRIVATE PROFITS MAY BE MAINTAINED WITHOUT CREATING UNDUE SOCIAL COSTS AND SO THAT OPTIMAL USES MAY BE MADE OF THE WATER. ECONOMIC EFFICIENCY WOULD REQUIRE THAT WATER AND WASTEWATER MANAGEMENT BE TREATED IN TERMS OF A SYSTEM. THAT IS, A SYSTEM USING WATER AND WASTEWATER MUST PROVIDE WAYS BY WHICH THE WATER CAN BE FED BACK INTO THE SYSTEM. (W72-10426).

00722. REGIONAL SEWERAGE SYSTEMS AND TREATMENT COSTS IN TEXAS.

CLASSEN, N.W.; SCALF, B.G.; COPELAND, J.B. JR.
PUBLIC WORKS MAGAZINE, APRIL, 1970. 21 P.

THE GREATER WATER QUALITY AND ECONOMIC BENEFITS REALIZED THROUGH IMPLEMENTATION AND OPERATION OF A REGIONAL SEWERAGE SYSTEM OVER THAT EXPERIENCED BY A SMALLER SYSTEM ARE DEMONSTRATED. BY USING THE REGIONAL PLAN THE POSSIBILITY OF HAVING TO BYPASS RAW OR PARTIALLY TREATED SEWAGE IS DIMINISHED. ADDITIONAL SAVINGS ARE ACCRUED THROUGH THE CONSOLIDATION OF OPERATIONAL MAINTENANCE FACILITIES, THIS BEING ESPECIALLY TRUE CONCERNING LABORATORY FACILITY COSTS. THE REGIONAL SYSTEM APPROACH TO WASTEWATER COLLECTION AND TREATMENT HAS BEEN FOUND TO BE A MOST EFFICIENT AND EFFECTIVE WAY TO HANDLE THIS SERVICE. HIGHER QUALITY EFFLUENT IS PRODUCED WHILE TOTAL COST PER PERSON DECREASES AS THE SIZE AND CAPACITY OF THE FACILITIES INCREASE. EVEN GREATER SIGNIFICANCE IS BEING ATTACHED TO THIS METHOD BECAUSE OF THE FACT THAT TERTIARY TREATMENT FACILITIES 'DOUBLE THE COST OF A PARTICULAR INSTALLATION. GREATER ECONOMIES WILL BE REALIZED BY THE AREA-WIDE APPROACH WHERE ADVANCED TREATMENT IS REQUIRED TO MAINTAIN ACCEPTABLE WATER QUALITY. AN AREA-WIDE SYSTEM MUST BE JUSTIFIED ON THE BASIS OF ECONOMIC FEASIBILITY AND MUST BE SHOWN TO SERVE THE BEST INTEREST OF THE PEOPLE AND THE WATER POLLUTION CONTROL NEED OF THE PARTICULAR AREA. THE END RESULT IS THE PRODUCTION OF A HIGHER QUALITY EFFLUENT AND A GREATER DEGREE OF POLLUTION ABATEMENT AT LESS COST PER UNIT VOLUME OF WASTEWATER COLLECTED AND TREATED. (W72-10853).

00723. COST AND PERFORMANCE OF RETENTION BASINS IN THE TREATMENT OF WET-WEATHER SEWAGE FLOWS.

WALLER, D.H.
PREPRINT, PRESENTED AT 6TH INTERNATIONAL WATER POLLUTION RESEARCH CONFERENCE, SESSION 9, PAPER NO. 18, JUNE 21, 1972. 10 P.

INFORMATION WAS OBTAINED ABOUT THE COMPOSITION AND FLOW RATES OF COMBINED SEWAGE AND SURFACE RUNOFF FROM A 168 ACRE DRAINAGE AREA AT HALIFAX, NOVA SCOTIA. SURFACE RUNOFF WAS THE MAJOR SOURCE OF COMBINED SEWAGE SOLIDS FROM THIS AREA. THESE FINDINGS, WHICH INDICATED THAT STORM RUNOFF, DISCHARGE UNTREATED, COULD BE A SIGNIFICANT SOURCE OF POLLUTION, LED TO THE DESIGN AND CONSTRUCTION OF A COVERED CONCRETE CATCH BASIN WITH 0.9 MILLION GALLON STORAGE VALUE. THE TANK WAS DESIGNED TO PROVIDE TREATMENT BY CHLORINATION AND SEDIMENTATION FOR COMBINED SEWAGE THAT IS DISCHARGED TO THE RECEIVING WATER WHEN THE TANK IS FILLED. THE RETENTION TANK WAS ALSO EQUIPPED WITH A TRASH SCREEN AND DESIGNED SO THAT THE ROOF BEAMS WOULD BE SUBMERGED ENOUGH WHEN THE TANK WAS FULL TO ACT AS SKIMMERS. ANALYSESSHOWED THE SEPARATE SYSTEM PRODUCED A TOTAL LOAD OF 590 LBS SUSPENDED SOLIDS AND 196 LBS BOD PER ACRE PER YEAR, WHILE THE COMBINED SYSTEM REDUCED THESE LOADS TO 218 AND 157 LBS/ACRE/YEAR, RESPECTIVELY. COST ANALYSES COMPARING SEWER SEPARATION TO RETENTION BASINS ARE ALSO PRESENTED. (W72-11043).

00724. COST RELATIONSHIP OF BIOLOGICAL AND THERMAL PROCESSES FOR THE TREATMENT OF INDUSTRIAL EFFLUENTS.

LOHMAN, J.
PREPRINT, PRESENTED AT 6TH INTERNATIONAL WATER POLLUTION RESEARCH CONFERENCE, SESSION 8, PAPER NO. 16, JUNE 21, 1972. 9 P.

WASTEWATER FROM A PLASTICS PLAN, ASSUMED TO BE REPRESENTATIVE OF A BROAD SECTION OF THE PLASTICS INDUSTRY, WAS TREATED IN THE LABORATORY IN 5 DIFFERENT TREATMENT SCHEMES. THE FIVE METHODS INCLUDED: (1) ACTIVATED SLUDGE SYSTEM; (2) PLASTIC TRICKLING FILTER; (3) SERIES COMBINATION OF TRICKLING FILTER AND ACTIVATED SLUDGE; (4) HIGH RATE ACTIVATED SLUDGE; AND (5) INCINERATION. CAPITAL EXPENDITURE FOR EACH SUGGESTED PLANT WAS BASED ON COST FACTORS CURRENTLY PREVAILING IN THE FEDERAL REPUBLIC OF GERMANY, AND INVESTMENT COSTS WERE ASSUMED TO BE 17% OF TOTAL ANNUAL CAPITAL EXPENDITURE. RESULTS DEMONSTRATED THAT (1) TRICKLING FILTRATION IS PARTICULARLY AMENABLE TO SITUATIONS WHERE PARTIAL TREATMENT IS REQUIRED; (2) EXTENSIVE PURIFICATION IS BEST ACHIEVED BY THE SERIES COMBINATION OF TRICKLING FILTER FOLLOWED BY ACTIVATED SLUDGE; (3) THE HIGH RATE ACTIVATED SLUDGE PROCESS IS PREFERABLE TO CONVENTIONAL ACTIVATED SLUDGE WHEN EXTREMELY HIGH DEGREES OF BOD REDUCTION ARE REQUIRED; AND (4) INCINERATION IS RECOMMENDED FOR WASTES WITH CONCENTRATIONS OF BOD5 GREATER THAN 30,000 TO 50,000 MG/L. (W72-11044).

00725. DEVELOPMENTS IN EFFLUENT TREATMENT IN THE FOOD INDUSTRY.

ANDERSON, D.
WATER AND SEWAGE WORKS, 117(7), IW/12-IW/22.

DEVELOPMENTS IN EFFLUENT TREATMENT RELATED TO THE FOOD INDUSTRY IN ENGLAND WERE DISCUSSED. TRADE WASTES MAY BE DISCHARGED INTO LOCAL AUTHORITY SEWERS AND A TREATMENT FEE BASED ON A MOGDEN TYPE FORMULA HAS BEEN CHARGED. OPERATIONS DEPENDENT ON VOLUME ONLY, REMOVAL OF SOLID MATTER AND OXIDATION PROCESSES HAVE BEEN CONSIDERED BY THIS COST FORMULA. THE BASIC CHARGE HAS MORE THAN DOUBLED DURING THE PERIOD FROM 1962 TO 1968 AS SHOWN BY THE INCREASE FROM 7.16 TO 15.72 CENTS/1000 IMPERIAL GALLONS. TREATABILITY STUDIES OF EFFLUENTS RELYING ON CHEMICAL TESTS MUST BE CONSIDERED. ALSO, WATER RECYCLE SYSTEMS MUST BE CONSIDERED DUE TO THE INCREASING COSTS OF RAW WATER AND WASTE DISCHARGES. THE COMBINED COST OF RAW WATER AND WASTE DISCHARGES HAS INCREASED

FROM 25 TO APPROXIMATELY 50 CENTS/1000 IMPERIAL GAL. DURING THE 1961-1969 PERIOD. THE PROCESS OF COUNTERFLOW RINSING SHOULD BE CONSIDERED IN AN ATTEMPT TO SAVE WATER. TWO EXAMPLES OF EFFLUENT PRE-TREATMENT FACILITIES UTILIZING HIGH-RATE BIOFILTERS WERE PRESENTED. (W72-11052).

00726. AERATED LAGOONS TREAT MINNESOTA TOWN'S WASTES.

NEIGHBOR, J.B.
CIVIL ENGINEERING, VOL 40, P 59-61, 1970.

A MULTIPLE-CELL AERATED LAGOON SYSTEM WAS DESIGNED AND CONSTRUCTED TO TREAT MUNICIPAL WASTES FROM THE TOWN OF WINSTED, MINNESOTA, WASTES FROM A SMALL CREAMERY, AND WASHWATERS FROM MINNESOTA'S LARGEST CHEESE PRODUCER. THREE LAGOONS IN SERIES, EQUIPPED WITH DIFFUSED AIR AERATION, NOW HANDLE 311,000 GPD OF INFLUENT CONTAINING 3600 LBS BOD5. ALL THREE LAGOONS MEASURE 120 FT. WIDE BY 1070 FT. LONG BY 10 FT. DEEP, WITH A COMBINED HOLDING CAPACITY OF 12,397,000 GALLONS AND A TOTAL RETENTION TIME OF 46 1/2 DAYS. DURING THE PAST 2 YEARS, REMOVAL OF BOD HAS AVERAGED 93 TO 99% AND REMOVAL OF VOLATILE DISSOLVED SOLIDS HAS AVERAGED 80 TO 98%. CONSTRUCTION COSTS WERE ONLY $224,000, AS COMPARED TO $485,000 ESTIMATED FOR A CONTACT STABILIZATION PLANT. OPERATING COSTS WERE $7000/YR AS COMPARED TO $17,000/YR FOR THE CONVENTIONAL PLANT. THE LAGOON SYSTEM ALSO PRODUCES NO SLUDGE HANDLING PROBLEMS AND PROVIDES A CONSISTENTLY HIGH DEGREE OF TREATMENT TO A WIDELY VARYING WASTE. (W72-11092).

00727. THE DEVELOPMENT AND EFFECT OF CONSTRUCTION AND OPERATION COSTS IN BIOLOGICAL SEWAGE TREATMENT PLANTS.

SICKERT, E.
PREPRINT, PRESENTED AT 6TH INTERNATIONAL WATER POLLUTION RESEARCH CONVERENCE, SESSION 7, PAPER NO 13, JUNE 21, 1972. 15 P.

THE COST OF WAGES IN THE WASTEWATER TREATMENT INDUSTRY HAS RISIN 100% AND COST OF CONSTRUCTION HAS RISEN 65% IN THE LAST TEN YEARS ALONE. ONE OF THE RESPONSIBILITIES OF RUNNING A WASTEWATER TREATMENT PLANT IS TO KEEP BOTH INITIAL AND OPERATIONAL COSTS TO A MINIMUM. FIRST, LARGER PLANTS COST LESS TO BUILD PER UNIT OF AVAILABLE CAPACITY, AND ALSO COST LESS TO OPERATE, INDICATING CENTRALIZATION OF FACILITIES AS A LOGICAL COST SAVING STEP. HOWEVER, SHARED CENTRALIZATION FACILITIES AND MANPOWER BY MANY PLANTS IN A CERTAIN DISTRICT CAN ALSO REALIZE COST SAVINGS. IN ADDITION, SINCE POWER COST HAS BEEN NEARLY STABLE AND IS PREDICTED TO CONTINUE SIMILARLY, REPLACEMENT OF LABOR BY AUTOMATION IS ANOTHER LOGICAL MEASURE. BY POINTING OUT THESE MEASURES AND ASSIGNING A WEIGHT TO THEIR INFLUENCE, AN EVEN HIGHER ECONOMY MAY BE ACHIEVED. ALTHOUGH THE LIST IS FAR FROM COMPLETE, THERE ARE MANY FUNDAMENTAL POSSIBILITIES OF IMPROVEMENT WHICH CAN BENEFIT FROM PREVIOUS EXPERIENCE AND JUDGMENT. (W72-11096).

00728. THE RIVER BASIN MODEL: ECONOMIC SECTOR.

ENVIRONMENTAL PROTECTION AGENCY, WATER POLLUTION CONTROL RESEARCH SERIES, DECEMBER, 1971. 151 P.

THE RIVER BASIN MODEL IS NOT PRIMARILY A WATER MANAGEMENT MODEL. IT IS A HUMAN INTERACTION, COMPUTER-SIMULATION DECISION-MAKING TOOL, REPRESENTING THE ENTIRE COMPLEX ECONOMIC, SOCIAL, AND GOVERNMENTAL ACTIVITIES OCCURRING WITHIN A SPECIFIED LOCAL SYSTEM. ITS USERS REPRESENT THE MAJOR ECONOMIC, SOCIAL, AND GOVERNMENTAL DECISION-MAKERS WHO CAUSE THE REGIONAL SYSTEM TO FUNCTION ON A YEAR-TO-YEAR BASIS. AS PART OF THE FUNCTIONING OF THIS SYSTEM, WATER IS DEMANDED BY INDUSTRIES AND MUNICIPAL WATER SUPPLIERS AND POLLUTION IS GENERATED BY MANUFACTURING AND COMMERCIAL ACTIVITIES, BY PEOPLE, AND BY FARM ACTIVITIES. THE MODEL PROVIDES COMPUTER PROGRAMS WHICH SIMULATE THE MAJOR PROCESSES. MODEL USERS PROVIDE INPUTS TO THESE PROGRAMS ON BEHALF OF BUSINESS ACTIVITIES IN THE ECONOMIC SECTOR, GROUPS OF PEOPLE OR POPULATION UNITS IN THE SOCIAL SECTOR, AND GOVERNMENT DEPARTMENTS IN THE GOVERNMENTAL SECTOR. A GAMING FORMAT IS EMPLOYED; ECONOMIC SECTOR TEAMS CONTROL REGIONAL ECONOMIC ASSETS: CASH, LAND, MANUFACTURING PLANTS, OUTSIDE INVESTMENTS, COMMERCIAL ACTIVITIES, AND/OR RESIDENCES. ECONOMIC DECISION-MAKERS ARE THOSE BUSINESSMEN WHO OPERATE COMMERCIAL, INDUSTRIAL, RESIDENTIAL AND FARM ESTABLISHMENTS. WATER DECISIONS ARE MADE WITHIN THEIR REALISTIC CONTEXT OF INTERACTION WITH THE REGIONAL PROCESSES. INDUSTRIAL ACTIVITIES USE SURFACE WATER AND ALL OTHER ECONOMIC BUSINESSES HAVE SOME NEED FOR MUNICIPALLY SUPPLIED WATER. (PB-210 861) (W72-11274).

00729. PAC-PCT PROCESS FOR WASTEWATER TREATMENT.

SHELL, G.L.; BURNS, D.E.
PUBLIC WORKS, 103(2), 71-73, 1972.

THE SANITARY RESEARCH AND DEVELOPMENT DEPARTMENT OF ENVIROTECH CORPORATION IS ENGAGED IN A COMPREHENSIVE APPLIED RESEARCH STUDY DEMONSTRATING THE EFFECTIVENESS AND ECONOMICS OF TREATING MUNICIPAL WASTE WATER BY A VARIATION OF PHYSICAL-CHEMICAL TREATMENT (PCT), USING POWDERED ACTIVATED CARBON (PAC) AS A PRIMARY STEP IN REMOVAL OF ORGANICS. THE PROCESSES WHICH ARE BEING EVALUATED ARE: CHEMICAL PRECIPITATION OF PHOSPHOROUS COMPOUNDS, COAGULATION-FLOCCULATION OF SUSPENDED SOLIDS SEPARATION, REMOVAL OF ORGANICS AND SOLIDS DESTRUCTION. THE ADVANTAGES OF THIS PROCESS OVER CONVENTIONAL BIOLOGICAL METHODS ARE: (1) SIGNIFICANTLY REDUCED LAND AREA IS REQUIRED, (2) TREATMENT EFFICIENCY IS NOT LOST WHEN BIOLOGICALLY TOXIC WASTES OR HIGH-STRENGHT WASTES ARE ENCOUNTERED, (3) THE ABILITY TO PRODUCE A HIGH QUALITY EFFLUENT, AND (4) THE POSSIBILITY OF INCREASED AUTOMATION WITH THE PCT PROCESSES. (W72-11479).

00730. POWDERED ACTIVATED CARBON APPLICATION, REGENERATION AND REUSE IN WASTEWATER TREATMENT SYSTEMS.

SHELL, G.L.; BURNS, D.E.
PREPRINT, PRESENTED AT SIXTH INTERNATIONAL WATER POLLUTION RESEARCH CONFERENCE,

SESSION 10, HALL C, PAPER NO 20, JUNE 21, 1972. 10 P.

ANALYSIS OF EXISTING OPERATING DATA AND COST ESTIMATES INDICATED THAT THE GREATEST POTENTIAL APPLICATION OF POWDERED ACTIVATED CARBON (PAC) SYSTEMS IS FOR: (1) MODERATE TO WEAK SOLUBLE ORGANIC WASTES; (2) MODERATE QUALITY EFFLUENT REQUIREMENTS; AND/OR (3) PLANT SIZES LESS THAN 5 MGD. A 2 YEAR STUDY OF A 100 GPM PILOT PLANT WAS CONDUCTED TO EVALUATE THE APPLICABILITY OF PAC FOR MUNICIPAL WASTEWATER TREATMENT BY: (1)ESTABLISHING GRAVITY THICKENING AND VACUUM DEWATERING CHARACTERISTICS AND OPERATING PARAMETERS; (2) ESTABLISHING FLUIDIZED BED REGENERATION OPERATING PARAMETERS; (3) DETERMINING THE REGENERATED PAC EFFECTIVENESS BY REUSE, WITH A SAND BED TEMPERATURE OF 154 DEG F. THE RESULTING FREEBOARD TEMPERATURE WAS 151 DEG F, FURNACE OPERATION WAS STABLE, AND CARBON LOSSES AMOUNTED TO 17%. SIX WEEK AVERAGES OF PILOT PLANT OPERATION COMPARING VIRGIN CARBON WITH ONCE TO TWICE REGENERATED CARBON SHOWED ESSENTIALLY NO DEGRADATION OF THE CARBON WITH REGARD TO COD REMOVAL EFFECTIVENESS. THE MAJOR PROBLEM ENCOUNTERED WITH THE FLUIDIZED BED REGENERATION FURNACE, THAT OF NON-PREFERENTIAL IGNITION OF BED INJECTION GAS IN DEFERENCE TO CARBON, MUST BE SOLVED BEFORE ANY FURTHER PROGRESS CAN BE MADE (W72-11615).

00731. COST OF CONVENTIONAL AND ADVANCED TREATMENT OF WASTE WATER.

SMITH, R.
JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 40(9), 1546-1574, 1968.

THE COST ASSOCIATED WITH BUILDING AND OPERATING WASTE WATER TREATMENT PLANTS IN INDIVIDUAL WASTE WATER PROCESSES IS PRESENTED. THE INFORMATION FROM SEVERAL SOURCES IS BROUGHT TOGETHER, USING A CONSISTENT SET OF ASSUMPTIONS AND OMISSIONS, FOR A USEFUL WORKING DOCUMENT. THE MAJORITY OF THE RESULTS ARE PRESENTED GRAPHICALLY WITH THE COST IN CENTS PER THOUSAND GALLONS PLOTTED AGAINST DESIGN CAPACITY IN MILLION OF GALLONS PER DAY. MOST OF THE CURVES VARY BETWEEN 1 AND 100 MILLION GALLONS PER DAY. SOME OF THE COSTS PRESENTED INCLUDE PRIMARY, ACTIVATED SLUDGE, AND TRICKLING FILTER PLANT CAPITAL, OPERATION, AND MAINTENANCE COSTS; COAGULATION AND SEDIMENTATION COSTS; FILTRATION, ADSORPTION, DO, AND CHLORINATION COSTS; CONTROL HOUSE COSTS; AND MANY OTHERS. (W70-06869).

00732. A STUDY OF WATER PLANT ISOLATION FROM CONTAMINATION.

CREVER, F.E.
OFFICE OF SALINE WATER RESEARCH AND DEVELOPMENT PROGRESS REPORT NO 526, 147 P, 1969.

POTENTIAL CONCENTRATIONS OF RADIOACTIVE NUCLIDES IN THE WATER PLANT BRINE, EFFLUENT, AND PRODUCT WATER WERE DETERMINED FOR DUAL PURPOSE POWER GENERATION AND DESALTING PLANTS USING NUCLEAR STEAM SUPPLY SYSTEMS. THE NUCLEAR STEAM SUPPLY SYSTEMS CONSIDERED WERE THOSE USING THE LIGHT WATER COOLED AND MODERATED REACTORS. THE DIRECT CYCLE SYSTEM USING THE BOILING WATER REACTOR AND THE PRESSURIZED WATER REACTOR USING THE INDIRECT CYCLE WERE BOTH CONSIDERED. A DESIGN BASIS WAS STUDIED FOR A PRESSURIZED, DEMINERALIZED WATER LOOP TO BE INSERTED BETWEEN THE HEATING STEAM FROM A NUCLEAR STEAM SUPPLY AND THE BRINE IN A MULTISTAGE FLASH SEA WATER DESALTING PLANT TO ALLOW EXTENDED OPERATION AT FULL CAPACTTY WITH BRINE HEATER LEAKAGE. THE LOOP IS TO BE PRESSURIZED TO ABOUT 10 PSI ABOVE BOTH THE HEATING STEAM AND THE BRINE SO THAT ANY LEAKAGE THAT OCCURS IN THE HEAT EXCHANGERS WOULD BE EITHER INTO THE NUCLEAR STEAM SUPPLY SYSTEM OR INTO THE WATER PLANT BRINE. THE LEAKAGE WOULD BE PURE WATER, WHICH WOULD NOT BE HARMFUL TO EITHER THE STEAM SUPPLY SYSTEM OR THE WATER PLANT. A DESIGN BASIS WAS ALSO STUDIED FOR AN ISOLATING LOOP USING STEAM AS THE WORKING FLUID BETWEEN A NUCLEAR STEAM SUPPLY AND A MULTISTAGE FLASH SEA WATER DISTILLATION PLANT. WITH HORIZONTAL BRINE HEATERS, THE STEAM TERMPERATURE WOULD HAVE TO BE RAISED TO 273 DEG F WHICH WOULD GIVE A STEAM PRESSURE OF 43.8 PSI IN ORDER TO INSURE STEAM PRESSURE ABOVE BRINE PRESSURE AT ALL POINTS OF POTENTIAL LEAKAGE. (GPO $1.50).

00733. THERMAL POLLUTION: THE EFFECT OF THE PROBLEM.

WURTZ, C.B.
ENVIRONMENTAL PROBLEMS, LIPPINCOTT CO. 1968, P 131-145.

THIS PAPER DISCUSSES THE EFFECTS OF ARTIFICIALLY INCREASED WATER TEMPERATURES. ONE OF THE GREATEST IMPEDIMENTS TO CONTROLLING THERMAL POLLUTION IS THE COST INVOLVED. THE AUTHOR DISCUSSES THE DIRECT RELATION BETWEEN COST AND WATER QUALITY AND GIVES SOME EXAMPLES OF THE DIFFICULTY OF DECIDING WHICH INVESTMENT TO MAKE. THE PAPER ALSO DISCUSSES THE BIOLOGICAL EFFECTS OF INCREASED WATER TEMPERATURE. THE AUTHOR DISPUTES SOME OF THE CURRENT THINKING AND ANALYZES THE EFFECT OF THERMAL POLLUTION ON DISSOLVED OXYGEN, AND THE METABOLIC RATES OF LIVING ORGANISMS. HEAT ADDED TO THE WATER WILL INCREASE THE PRODUCTIVITY OF THAT WATER, AND, IN THE LONG RUN, BRING HIGHER FISH YIELDS. THE AUTHOR CONCLUDES WITH AN ANALYSIS OF THE COSTS OF CONTROLLING WATER POLLUTION AND ARGUES FOR REALISTIC GOALS IN CONTROL REGULATIONS. (W70-08719).

00734. REVERSE OSMOSIS CAN CUT COST OF WATER TREATMENT.

MEYERS, J.H.
INDUSTRIAL WATER ENGINEERING, 7(3), 25-30, 1970.

THE MASS PRODUCTION OF UNIFORM QUALITY MEMBRANES WAS SAID TO BE THE MAIN ITEM RESPONSIBLE FOR THE POPULARITY AND COMPETIVENESS OF INSTALLATION OF INDUSTRIAL REVERSE OSMOSIS. THE MEMBRANE AS THE HEART OF THE RO SYSTEM HAD THE CHARACTERISTICS OF PERMITTING THE PASSAGE OF WATER WHILE ACTING AS A BARRIER TO THE PASSAGE OF DISSOLVED OR SUSPENDED SOLIDS. LONG TERM PERFORMANCE WAS BASIC TO THE VALUE OF THE REVERSE OSMOSIS SYSTEM AND IT WAS IMPORTANT THAT THE TOTAL INSTALLATION, INCLUDING PRETREATMENT, BE DESIGNED FOR OPTIMUM PERFORMANCE AND HIGH AVAILABILITY. IN-PLANT EXPERIENCE GATHERED OVER THE PAST TWO YEARS SERVED AS A BASIS TO HELP INSURE GOOD OVERALL DESIGN AND DETERMINE ECONOMIC FEASIBILITY. THE PRIMARY FACTORS THAT DETERMINED PERFORMANCE OF REVERSE OSMOSIS WERE: (1) APPLIED PRESSURE; (2) CONCENTRATION OF THE DISSOLVED SOLIDS IN THE FEED; (3) TEMPERATURE OF THE FEED; AND (4) THE POROSITY OR PERMEABILITY OF THE

MEMBRANE TO FILTRATION AND CHEMICAL ADDITION. THE MAJOR USE FOR REVERSE OSMOSIS WAS FOR THE PRODUCTION OF HIGH PURITY DEMINERALIZED WATER. THE APPLICATION OFFERED FLEXIBILITY IN PRODUCING WATER OF MANY QUALITIES FOR VARIOUS PLANT REQUIREMENTS. THE COMPONENTS OF THE RO SYSTEM INSTALLATION WERE DESCRIBED. THE CAPITAL AND OPERATING COSTS OF REVERSE OSMOSIS EQUIPMENT DECREASED SIGNIFICANTLY AS SIZE INCREASED. TYPICAL CAPITAL AND OPERATING COSTS FOR A RANGE OF CAPABITIES WERE SHOWN. (W70-08851).

00735. ECONOMICS OF THERMAL DISCHARGES.

LOF, G.; WARD, J.
INDUSTRIAL WATER ENGINEERING, 7(1) 12-18, 1970.

ECONOMIC IMPLICATIONS OF THERMAL DISCHARGES WERE EXAMINED. THE DISCHARGES FROM POWER PLANTS AND THE POTENTIAL EFFECT THAT THE DISCHARGES HAVE ON DOWNSTREAM WATER USERS, THAT IS ON DOWNSTREAM WATER USED FOR COOLING PURPOSES, WERE DESCRIBED. IT WAS POINTED OUT IN THE LITERATURE THAT THE TEMPERATURE OF WATER USED FOR COOLING PURPOSES WAS OFTEN OF MORE SIGNIFICANCE THAT THE COMPOSITION AND CHEMICAL QUALITY OF WATER. THE MAIN OBJECTIVE WAS TO INDICATE THE APPROXIMATE RANGE OF COSTS INVOLVED IN COMPLETELY PREVENTING THERMAL DISCHARGE; I. E., BY CIRCULATING WATER THROUGH COOLING TOWERS, AND TO SHOW THE APPROXIMATE COSTS TO A DOWNSTREAM POWER PLANT BEING FORCED TO USE COOLING WATER CONTAINING THERMAL DISCHARGES FROM AN UPSTREAM ELECTRIC STATION. THE COST OF COOLING WATER RECIRCULATION INCLUDED CAPITAL COSTS, PRIMARILY OF THE COOLING TOWER INSTALLATION, AND OPERATING COSTS, WHICH WERE THE MAKE-UP WATER, CHEMICALS, AND POWER FOR OPERATING FANS AND PUMPS. THE CAPITAL COSTS WERE DEPENDENT UPON WATER FLOW REQUIRED, PREVAILING WET BULB TEMPERATURE OF THE AIR, THE WATER TEMPERATURE CHANGE THROUGH THE TOWER, AND THE TEMPERATURE OF WATER DELIVERY FROM THE COOLING TOWER TO THE CONDENSER. THE CAPITAL COST OF THE COOLING TOWER INSTALLATION WAS ESTIMATED FROM CHARTS AND TABLES AND AN EXAMPLE WAS GIVEN. ECONOMIC CONSEQUENCES OF THERMAL DISCHARGE, SUCH AS WATER LOSS BY EVAPORATION, WERE DISCUSSED. (W70-08852).

00736. WASTE WATER CHARGES IN GREAT BRITAIN.

WOOD, R.
INDUSTRIAL WATER ENGINEERING, 7(1), 22-29, 1970.

A DESCRIPTION OF CHARGES FOR INDUSTRIAL WASTE TREATMENT IN GREAT BRITAIN WHICH SERVE AS A MEANS OF CONTROLLING THE QUALITY OF THE WASTES DISCHARGED TO THE SEWER, THEREBY CONTROLLING IN TURN THE INFLUENT QUALITY AT THE MUNICIPAL TREATMENT PLANT, WAS GIVEN. THE AUTHORIZATION OF A CHARGE FOR THE SERVICE OF SEWERAGE AND TREATMENT PLANT WAS GIVEN. THE AUTHORIZATION OF A CHARGE FOR THE SERVICE OF SEWERAGE AND TREATMENT AT THE MUNICIPAL TREATMENT PLANT WAS INITIATED IN 1937 AND IN 1961 THE POWERS OF THE LOCAL AUTHORITIES WERE EXTENDED. THE POLICY DESCRIBED IS THAT OF THE INSTITUTE OF WATER POLLUTION CONTROL. AN EXAMPLE GIVEN WAS THAT OF THE MOGDEN WORKS OF THE MIDDLESEX COUNTY COUNCIL WHERE THEY FIRST DEVISED A VOLUME/STRENGTH/SOLIDS FORMULA WHICH PROVED WORKABLE OVER A WIDE RANGE OF INDUSTRIAL WASTES. TO BE EFFECTIVE THE FORMULA GIVEN STEMMED FROM AN ACCURATE CALCULATION OF THE NET COSTS OF TREATMENT AT THE MUNICIPAL TREATMENT PLANT. RATES THEMSELVES WERE INCLUDED AND ADMINISTRATIVE OVERHEADS DIVIDED BETWEEN CAPITAL AND REVENUE EXPENDITURE. THE SHMDA HAD OPERATED A CHARGING SCHEME BASED ON THIS FORMULA FOR A NUMBER OF YEARS. FOR NON-INHIBITING WASTES, THE USE OF THE MCGOWAN STRENGTH IN VOLUME/STRENGTH/SOLIDS FORMULA ASSESSED TREATABILITY TO SOME EXTENT. THIS WAS A CALCULATION OF THE OXYGEN REQUIREMENT FOR COMPLETE OXIDATION. EXAMPLES OF THE USE OF THIS METHOD WERE GIVEN. PROCESS OXYGEN DEMAND (POD) WAS SUGGESTED BY SIMPSON AS CHARGES FOR INDUSTRIAL WASTE TREATMENT BASED ON REQUIREMENTS OF THE PROCESS TO EFFECT TREATMENT. HE INDICATED THE POSSIBLE BREAKDOWN OF UNIT PROCESSES AND HIS FORMULA WAS SHOWN. CONTROL OF INDUSTRIAL WASTES COULD ACHIEVE OPTIMUM OPERATING CONDITION AT THE TREATMENT PLANT AND A MINIMUM CHARGE TO BOTH THE GENERAL RATE PAYERS AND THE INDUSTRIAL WASTE DISCHARGE ACHIEVED. (W70-08853).

00737. CATTLE, SWINE AND CHICKEN MANURE CHALLENGES WASTE DISPOSAL METHODS.

LAAK, R.
WATER AND SEWAGE WORKS, 117(4), 134-138, 1970.

IN THE UNITED STATES TODAY APPROXIMATELY 0.66 BILLION LBS PER DAY OF MANURE MUST BE EXTENSIVELY TREATED OR DESTROYED. THE TRENDS IN AGRICULTURE INDICATE THAT MORE LIVESTOCK WILL BE CONFINED IN THE FUTURE, THE CONCENTRATION OF THE WASTES INCREASED, AND THE VOLUME OF MANURE PER ANIMAL SLOWLY REDUCED. EXTENSIVE DATA WAS COLLECTED AND IS PRESENTED GIVING THE GENERAL CHARACTERISTICS OF FECES AND URINE OF CATTLE, SWINE, AND POULTRY AS WELL AS THE QUANTITATIVE CONSUMPTION OF FEED, NITROGEN, PHOSPHOROUS, AND POTASH. THE MANURE CHARACTERISTICS ARE SAID TO BE CHANGING AND THEREFORE THE TREATMENT PROCESS PRINCIPLES MUST ALSO BE CHANGED. COSTS AND LAND REQUIREMENTS ARE GIVEN FOR MANURE DISPOSAL AND AN EXTENSIVE OUTLINE ENUMERATES THE LARGE VARIETY OF AVAILABLE DISPOSAL METHODS ALONG WITH EACH ONE'S PARTICULAR DRAWBACK. THE AVERAGE COST OF MANURE SEPARATION AND FINAL DISPOSAL MUST BE A FRACTION OF $30 TO $40 PER TON. (W70-06866).

00738. PROFESSIONALISM AND WATER POLLUTION CONTROL IN GREATER CHICAGO.

BACON, V.W.; DALTON, F.E.
JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 40(9), 1586-1600, 1968.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, FORMED IN 1889, HAS SUCCESSFULLY KEPT POLLUTION OUT OF THE AREA'S WATER SUPPLY AND WATER RECREATION. THE INITIAL PHASE INVOLVED CONSTRUCTION OF CANALS TO CONVEY WASTES OVER A LOW DIVIDE AWAY FROM LAKE MICHIGAN TO TRIBUTARIES OF THE MISSISSIPPI RIVER SYSTEM. THE NEED FOR LESSENING POLLUTION IN THESE CHANNELS LED TO CONSTRUCTION OF WASTEWATER TREATMENT PLANTS, THE LARGEST OF WHICH TREATS ONE BILLION GALLONS A DAY. BECAUSE OF URBAN GROWTH AND HIGHER WATER QUALITY STANDARDS $713,000,000 WORTH OF NEW FACILITIES WILL BE NEEDED BY THE YEAR 2000. THESE WILL INCLUDE SOLIDS DISPOSAL BY RECLAMATION OF MARGINAL AND STRIP MINE LAND AND UNDERGROUND STORAGE SYSTEM FOR COMBINED SEWER STORM FLOWS, TERTIARY TREATMENT, AND CHLORINATION. PROFFESSIONALISM IS NEEDED TO GUIDE THESE DEVELOPMENTS AND TO MAKE PROBLEMS AND RECOMMEND SOLUTIONS UNDERSTOOD BY PUBLIC OFFICIALS. (W70-06871).

00739. CASE HISTORY OF WASTE WATER TREATMENT ON A GENERAL ELECTRIC APPLIANCE PLANT.

ANDERSON, J.W.; IOBST, E.H.JR.
JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 40(10), 1786-1795, 1968.

WASTE WATER DISCHARGES FROM A SMALL APPLIANCE PLANT ARE TREATED TO REMOVE METAL IONS, ACIDS, AND ALKALI. THE CURRENT AVERAGE FLOW IS 230 MILLION GALLONS PER YEAR. THE INITIAL EQUIPMENT INSTALLED AND THE MANNER IN WHICH THE TREATMENT SYSTEM HAD BEEN EXPANDED TO KEEP PACE WITH EXPANDING MANUFACTURING OPERATIONS ARE DISCUSSED. SPECIFICALLY COVERED ARE: (1) DESCRIPTION OF THE SOURCES OF WASTE WATERS GENERATED, (2) VOLUMES OF WASTE WATER, (3) ANALYSIS OF WASTE STREAMS, (4) TREATMENT PLANT PERFORMANCE, (5) COSTS, AMOUNTS AND FREQUENCY OF USE, (6) LABOR, MAINTENANCE, AND UTILITY EXPENSES, AND (7) ANNUAL FIXED COSTS OF OPERATION. (W70-06876).

00740. SOME SEWAGE PROBLEMS IN EUROPE TODAY.

BAARS, J.K.
WATER POLLUTION CONTROL, 68(5) P 529-534, 1969.

SEVERAL EUROPEAN WASTE WATER TREATMENT PROBLEMS INCLUDING EUTROPHICATION, NITROGEN AND PHOSPHORUS REMOVAL, DETERGENTS, INSECTICIDES, AND PHENOLS ARE DISCUSSED. THE FACILITIES, CAPITAL AND OPERATING COSTS OF SEVERAL EUROPEAN TREATMENT PLANTS ARE ALSO DISCUSSED. SOME 10,000 METRIC TONS OF PHENOLS OR ABOUT TWO THIRDS OF THE PHENOLS RELEASED BY THE COKING PLANTS IN THE EMSCHER AND LIPPE RIVER BASINS ARE INTERCEPTED AND TREATED YEARLY IN 25 DEPHENOLATING PLANTS. THE INHABITANT EQUIVALENT, WIDELY DEFINED AS EQUAL TO 51 G BOD/DAY, IS NOT REGARDED AS RELIABLE FOR DESIGN. INSTEAD, THE ACTUAL LOADING SHOULD BE USED FOR DESIGN. SEVERAL EUROPEAN COUNTRIES HAVE OUTLAWED THE USE OF HARD DETERGENTS DUE TO THEIR RESIDUAL EFFECTS IN WATER. SURFACE ACTIVE SUBSTANCES HAVE BEEN FOUND TO INFLUENCE THE OXYGEN EXCHANGE COEFFICIENT IN WATER. UNDESIRABLE ALGAE GROWTHS OCCUR WHEN THE PHOSPHORUS CONCENTRATION EXCEEDS 0.1 MG/L AND THE NITROGEN CONCENTRATION EXCEEDS 0.3 MG/L. THE AVERAGE DAILY HUMAN EXCRETIONS CONTAIN 0.7-3.7 G OF P, OF WHICH 50-60% IS IN THE URINE. MODERN DETERGENTS CONTAIN 37-48% PHOSPHATES ON A DRY BASIS. EXPERIMENTATION IS IN PROGRESS TO REPLACE PHOSPHATES BY NITRILO TRIACETATE. PHOSPHORUS CAN BE EFFECTIVELY REMOVED BY CHEMICAL PRECIPITATION. USING LIME CA(OH)2 AS A COAGULANT, 93.4% P REMOVAL WAS OBTAINED AT A DOSAGE OF 1.5 TIMES THE CARBONATE HARDNESS AS CACO3. INTERNATIONAL COOPERATION ON A RIVER BASIN OR REGIONAL SCOPE IS NEEDED TO CURB POLLUTION IN EUROPE. (W70-06881).

00741. HIGH QUALITY REUSE WATER BY CHEMICAL-PHYSICAL WASTE WATER TREATMENT.

ZUCKERMAN, M.M.; MOLOC [illegible].
JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, VOL.42(3) 437-456, 1970.

WITH THE INCREASING DEMAND FOR HIGH QUALITY WATER FOR REUSE, AN EFFORT IS MADE TO MAXIMIZE THE EFFECTIVENSS OF ACTIVATED CARBON ADSORPTION. INCREASING THE PH TO A VALUE OF 11.5 IS REPORTED TO CAUSE CHEMICAL HYDROLYSIS. THIS HYDROLYSIS PRETREATMENT BEFORE ACTIVATED CARBON ADSORPTION RESULTS IN A BETTER QUALITY WATER FOR RAW WASTE WATER THAN FOR ACTIVATED SLUDGE EFFLUENT WHEN BOTH ARE SUBJECTED TO THE SAME PRE-ADSORPTION CHEMICAL HYDROLYSIS. THE CONVENTIONAL TERTIARY TREATMENT WHICH INCLUDES ACTIVATED SLUDGE TREATMENT WAS FOUND TO BE INFERIOR, BOTH QUALITATIVELY AND ECONOMICALLY TO THE CHEMICAL PRE-TREATMENT FOLLOWED BY ACTIVATED CARBON TREATMENT. (W70-06882).

00742. A CHEMICAL-PHYSICAL WASTE WATER RENOVATION PROCESS FOR KRAFT PULP AND PAPER WASTES.

SMITH, D.R.; BERGER, H.F.
JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 40(9) 1575-1581, 1968.

THE NATURE OF PULP AND PAPER WASTES MAKES IT DIFFICULT TO OBTAIN THE NECESSARY REDUCTION OF BOD, COLOR, AND DISSOLVED SOLIDS WITH A SINGLE TREATMENT PROCESS. PROPOSED IS AN OVERALL TREATMENT SCHEME WHICH HANDLES THE WASTE WATER STEPWISE TO PRODUCE A REUSABLE PROCESS WATER. A FOUR STAGE PROCESS UTILIZING LIME DOSING, BIOLOGICAL TREATMENT, ACTIVATED CARBON FILTRATION, AND DEMINERALIZATION WAS USED ON BLEACHED AND UNBLEACHED CRAFT, TOTAL MILL EFFLUENT. A THREE STAGE SYSTEM WITHOUT BIOLOGICAL TREATMENT ALSO WAS TESTED. BIOCHEMICAL OXYGEN DEMAND (BOD) AND COLOR REMOVAL WERE 97% AND 99.5%, RESPECTIVELY, FOR FOUR STAGE; AND 85.5% AND 99.5%, RESPECTIVELY, FOR THREE STAGE. COST COMPARISONS ARE MADE. THE FOUR STAGE PROCESSED REUSABLE WATER WOULD COST APPROXIMATELY 4.5 CENTS/1000 GALLONS, AND THE THREE STAGE PROCESS WOULD COST APPROXIMATELY 10 CENTS/1000 GALLONS. (W70-06889).

00743. AERATION SWEETENS HARBOR BASIN IN LOS ANGELES.

CRUSE, H.
WATER AND POLLUTION CONTROL, 108(4) P 42-44, 1970.

A VEGETABLE OIL REFINERY IS DISCHARGING ABOUT 10,000 POUNDS OF BOD PER DAY TO SLIP NUMBER 5 IN THE LOS ANGELES HARBOR. THIS, ALONG WITH AN ESTIMATED 14,000 POUNDS OF BOD PER TIDAL CHANGE, CAUSED A POLLUTION PROBLEM. IN 1968 A WIDER PROGRAM OF WATER QUALITY CONTROL WAS ENFORCED AND IT WAS NECESSARY TO PROVIDE TREATMENT. THE COST OF ON-SITE BOD TREATMENT WAS PROHIBITIVE, ON THE ORDER OF A QUARTER OF A MILLION DOLLARS, AND FORCED MAIN PUMPING TO THE NEAREST TREATMENT PLANT WOULD COST $420,000 FOR CONSTRUCTION AND $40,000 ANNUALLY. FINALLY IT WAS DECIDED TO TREAT THE ENTIRE BODY OF POLLUTED WATER. THE AVOIDANCE OF NAVIGATIONAL PROBLEMS ELIMINATED THE USE OF A SURFACE AERATOR AND A NOVEL AIR DIFFUSER HAD TO BE USED. THE AIR DIFFUSER IS ANCHORED TO THE BOTTOM OF THE BODY OF WATER AND IS HELD ERECT BY THE VERTICAL FLOW OF AIR. WHEN THE AIR FLOW IS SHUT OFF THE DIFFUSER WILL SINK TO THE BOTTOM AND THUS ALLOW SHIPS TO PASS OVER. NOT THE LEAST OF THE CONSIDERATIONS WAS THE ESTIMATED COST OF $130,000 CAPITAL COST, AND $20,000 ANNUAL COST, VERY MUCH LOWER THAN THE OTHER METHODS CONSIDERED. SLIP NUMBER 5 SHOWED AN UNEQUIVOCAL AND MARKED IMPROVEMENT. THIS ACHIEVEMENT WAS FOUND TO BE DUE TO TWO DIFFERENT EFFECTS EXERTED BY THE SYSTEM. FIRST, IT ACTED AS A MIXING DEVICE INCREASING THE DILUTION FACTOR TEN FOLD, AND

SECOND, IT INCREASED SUPPLY OF DISSOLVED OXYGEN IN THE ORDER OF 1 LB OXYGEN PER HORSEPOWER HOUR. (W70-06897).

00744. DIVISION OF COST RESPONSIBILITY FOR WASTE WATER SYSTEMS.

JOHNSON, J.A.

JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 42(3), 341-353, 1970.

COST OF WASTE WATER COLLECTION AND TREATMENT SYSTEMS ARE HIGH AND ARE LIKELY TO REMAIN SO BECAUSE OF EMPHASIS ON HIGH WATER QUALITY. THEY ARE MET BY A COMBINATION OF GENERAL REVENUE, SPECIAL ASSESSMENTS, SERVICE CHARGES AND GRANTS. BECAUSE COSTS ARE HIGH IT IS IMPORTANT THAT THEY BE ALLOCATED FAIRLY AMONG USERS, PROPERTY OWNERS, AND THE GENERAL PUBLIC. A NUMBER OF FORMULAS, NAMELY, PUBLIC UTILITIES, DIFFERENTIAL BENEFITS, HISTORICAL, ADDED EXPENDITURE, ALTERNATIVE REVENUE, CAPITAL AND OPERATING COST, RELATIVE USE, AND JOINT COMMITTEE FORMULAS HAVE BEEN PROPOSED FOR THE COST ALLOCATION. THESE VARY GREATLY IN THE BURDEN ASSIGNED TO EACH GROUP. CONSIDERATION OF THE NATURE OF WASTE WATER SERVICE, BENEFITS RECEIVED BY GROUPS WITHIN SOCIETY AND RESPONSIBILITY OF DISPOSING OF WASTE GOVERN THE ALLOCATION. (W70-06903).

00745. WASTE WATER TREATMENT AND RENOVATION STATUS OF PROCESS DEVELOPMENT.

STEPHAN, D.G.; SCHAFFER, R.B.

JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 42(3), 399-410, 1970.

THE ADVANCED WASTE WATER TREATMENT TECHNOLOGY BEING DEVELOPED AND STUDIED IN THE UNITED STATES AT THE CURRENT TIME IS TABULATED. OVER 350 STUDIES IN 95 CATEGORIES OF ADVANCED WASTE TREATMENT ARE LISTED. SOME OF THE PROCESSES, ALTHOUGH STUDIED MANY YEARS AGO, HAVE FOUND RENEWED PROMISE DUE TO SCIENTIFIC BREAKTHROUGH. OTHERS, SUCH AS ULTRAFILTRATION, ELECTRO-OSMOSIS, AND PLASMA ARC ARE INDICATIVE OF THE DEVELOPING TECHNOLOGY OF THE WASTE WATER TREATMENT FIELD. THE STUDY OF MODIFIED ACTIVATED SLUDGE HAS INCREASED MORE THAN THREE-FOLD IN TWO YEARS. ADVANCES HAVE BEEN SEEN SINCE 1967 WITH THE USE OF ACTIVATED CARBON AND THE NUMBER OF PROJECTS ON NUTRIENT REMOVAL HAS DOUBLED IN TWO YEARS. THE INDEPENDENT PHYSICAL-CHEMICAL TREATMENT PROCESS, UNDER STUDY AT SEVERAL LOCATIONS, IS DISCUSSED EXTENSIVELY. INCLUDED IN THE TABULATION ARE THE TREATMENT PROCESSES, SCALE, AND LOCATION. (W70-06908).

00746. TREATMENT OF COMBINED KRAFT AND NEWSPRINT EFFLUENTS AT AN ALABAMA PAPER MILL.

COTTLE, B.J.JR; NEWBAUER, H.; BUCK, J.; BILLINGS, R.M.

JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 40(7) 1314-1331, 1968.

THE OXYGEN CONTENT OF WATER SUPPLIED TO THE PAPER MILL ON THE COOSA RIVER, ALABAMA, WILL BE GREATLY REDUCED WHEN CONSTRUCTION OF A POWER DAM IS COMPLETED. ALSO, THE RAISING OF THE HEIGHT OF A DAM DOWNSTREAM WILL REDUCE THE REAERATION CAPABILITIES OF THE RECEIVING WATERS. A 274 FOOT DIAMETER PRIMARY CLARIFIER, AND 370 ACRE FINAL LAGOON WERE ADDED TO THE EXISTING FACILITIES (A CONVENTIONAL LAGOONSYSTEM) AND WILL PERMIT REMOVAL OF 97% OF THE EFFLUENT SUSPENDED SOLIDS, AND 35% AND 78% OF THE BOD IN WINTER AND SUMMER, RESPECTIVELY. THE SLUDGE IS THICKENED FROM 5% TO 18% THROUGH THE USE OF CENTRIFUGES. THE CONSTRUCTION OF UNDER WATER WEIRS ABOVE THE TWO UPSTREAM DAMS HAS INCREASED THE DISSOLVED OXYGEN IN THE WATER SUPPLIED TO THE MILL. THE FINAL LAGOON ALLOWS RELEASE TO THE RIVER TO BE COORDINATED WITH THE RIVER FLOWS. THE RIVER REQUIREMENTS ARE SUCH THAT A MINIMUM OF 4 MG/L DO IS TO BE MAINTAINED. CAPITAL COST OF THE TREATMENT IS APPROXIMATELY 2.5 MILLION DOLARS, OPERATING COSTS ABOUT $125,000 PER YEAR. (W70-06910).

00747. BUILDING FOR THE FUTURE--THE BOSTON DEEP-TUNNEL PLAN.

PARTHUM, C.A.

JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 42(4), 500-510, 1970.

A DEEP-TUNNEL STORAGE PLAN HAS BEEN PROPOSED TO PREVENT POLLUTION DUE TO DISCHARGE OF WASTEWATER OVERFLOWS AND MIXED WASTEWATER AND STORMWATER FROM THE COMBINED SEWERS OF BOSTON AND ADJACENT MUNICIPALITIES. OTHER METHODS SUCH AS COMPLETE SEWER SEPARATION, CHLORINATION TANKS, AND HOLDING TANKS WERE CONSIDERED, BUT THE DEEP-TUNNEL SYSTEM APPEARED MOST ECONOMICAL. CONSTRUCTION COSTS WERE ESTIMATED AT $430 MILLION AND CAPITALIZED OPERATION AND MAINTENANCE AT $66 MILLION. THE PROPOSED SYSTEM CONSISTS OF 17.2 MILES OF 33-FT DIAM DEEP TUNNELS IN A RADIAL PATTERN, A PUMPING CAPACITY OF 2,400 CFS AND A 45,000-FT OCEAN OUTFALL WITH DIFFUSERS. THE SYSTEM IS DESIGNED TO HANDLE RUNOFF FROM THE 15-YR-FREQUENCY STORM OF 24-HR DURATION WITHIN 2 DAYS, WITHOUT SURCHARGING AND THE MAXIMUM RECORDED STORM FOR BOSTON IF SURCHARGING IS PERMITTED. (W70-07364).

00748. REVERSE OSMOSIS PROCESS FOR WATER REUSE APPLICATION.

CHANNABASAPPA, K.C.

WATER-1969, CHEMICAL ENGINEERING PROGRESS SYMPOSIUM SERIES 97, VOL 65, PUBLISHED BY AMERICAN INSTITUE OF CHEMICAL ENGINEERS, NEW YORK, 140-147, 1969.

TECHNICAL DETAILS OF THE REVERSE OSMOSIS WASTE WATER TREATMENT PROCESS AND AN ECONOMIC EVALUATION OF ITS APPLICATION TO THE TREATMENT AND REUSE OF SECONDARY SEWAGE EFFLUENTS OR INDUSTRIAL WATER WASTES ARE PRESENTED. UNDER PRESENT CONDITIONS, COSTS RANGE FROM 20 TO 35 CENTS/1,000 GAL; ADVANCES IN REVERSE-OSMOSIS MEMBRANE TECHNOLOGY IN THE NEAR FUTURE ARE EXPECTED TO LOWER THESE COSTS FURTHER. (W70-07389).

00749. THE ENGINEERING EVALUATION OF REVERSE OSMOSIS AS A METHOD OF PROCESSING SPENT LIQUORS OF THE PULP AND PAPER INDUSTRY.

AMMERLAAN, A.C.F.; WILEY, A.J.

WATER-1969, CHEMICAL ENGINEERING PROGRESS SYMPOSIUM SERIES 97, VOL 65, PUBLISHED BY

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, NEW YORK, P 148-155, 1969. 8.

EVALUATION OF DATA FROM THE FIRST OF SIX, 3-MO. TRIALS OF A LARGE (50 TO 100,000 GAL/DAY) PILOT SCALE REVERSE OSMOSIS PROCESSING UNIT OPERATING AT VARIOUS PULP MILLS AND ON DIFFERENT TYPES OF SPENT LIQUORS, CONFIRMS 90% OR BETTER RECOVERY OF HIGH QUALITY WATER AND REJECTIONS OF DISSOLVED ORGANICS AND INORGANICS AT THE 90 TO 99% LEVEL IN THE CONCENTRATE. THE UNIT OPERATED 46% OF AVAILABLE TIME TO PROCESS 1,260,000 GAL. OF CALCIUM BASE SULFITE WASH WATER CONTAINING 1% SOLIDS AND CONCENTRATED TO THE 7 TO 16% RANGE. PROBLEMS ENCOUNTERED INCLUDED RELIABILITY OF MECHANICAL EQUIPMENT, PUMPS, PH CONTROL, MEMBRANE MODULE FAILURES AND PROCESSING PROBLEMS FOR CONTROL OF GYPSUM SCALE, AND MEMBRANE FOULING WITH SILICATE-PITCH COMPLEXES. ALL PROBLEMS EXCEPT LIFE OF MEMBRANE MODULES WERE FOUND CAPABLE OF BEING HANDLED SATISFACTORILY. MEMBRANE EQUIPMENT LIFE REQUIRES FURTHER DEVELOPMENT BY SUPPLIERS. COSTS WERE FOUND TO BE WELL BELOW OTHER METHODS OF CONCENTRATION SUCH AS BY EVAPORATION. (W70-07390).

00750. INSTALLATION AND OPERATION OF UPWARD-FLOW CLARIFIERS AT WORKS OF THE LICHFIELD RDC.

PULLEN, K.G.
WATER POLLUTION CONTROL, 68(6), 635-638, 1969.

DURING A TWO AND ONE-HALF YEAR PERIOD CLARIFIERS WERE INSTALLED AT THREE SMALL SEWAGE TREATMENT PLANTS (7000-24,500 IMPERIAL GALLONS/DAY). IN TWO CASES THE CLARIFIERS WERE INSTALLED IN THE HUMUS TANKS WHILE IN THE OTHER CASE A SEPARATE UNIT WAS CONSTRUCTED. INFORMATION CONCERNING THE DESIGN, INSTALLATION AND PERFORMANCE OF THE CLARIFIERS IS GIVEN. SATISFACTORY EFFLUENTS WERE PRODUCED AT SURFACE LOADINGS OF LESS THAN 20 IMP GALLONS/HOUR. THE USE OF SMALL STONE OR PEA GRAVEL IN THE BOTTOM OF THE CLARIFIER RESULTED IN THE NEED TO BACKWASH DAILY; WHILE IF LARGER MEDIA, 3/4 TO 1 INCH, WERE USED BACKWASHING WAS NECESSARY AT TWO-WEEK.

00751. OZONE: THE COMMING TREATMENT?

MCNABNEY, R.; WYNNE, J.
WATER & WASTES ENGINEERING, 8, 46-48, 1971.

00752. A SURVEY OF INDUSTRIAL WASTE TREATMENT COSTS AND CHARGES.

STONE, R.; SCHMIDT, C.
PROCEEDINGS OF THE INDUSTRIAL WASTE CONFERENCE, 23RD, PURDUE UNIVERSITY, P 49-62, 1968.

A PRELIMINARY ANALYSIS WAS PRESENTED OF THE EXTENT TO WHICH THE CITIES OF AMERICA HAVE MET THE CHALLENGE OF PROVIDING INDUSTRIAL WASTE DISPOSAL ON AN EQUITABLE COST BASIS. ESTIMATES WERE PROJECTED FOR WASTE QUANTITIES GENERATED, SEWER USE, AND CAPITAL OUTLAYS ASSOCIATED WITH INDUSTRIAL WASTE. APPROXIMATELY ONE THIRD OF THE CITIES PROVIDED FOR SEPARATE INDUSTRIAL WASTE CHARGES WITH THE MAJORITY OF THESE USING VOLUME AS THE ONLY CRITERION. IT WAS REPORTED THAT THE AVERAGE ANNUAL COST OF SEWAGE SERVICES TO A CITIZEN LIVING IN A COMMUNITY OF UNDER 100,000 POPULATION WAS APPROXIMATELY $20 AND THE AVERAGE ANNUAL PER CAPITA COST IN LARGE COMMUNITIES WAS $14. THE RESULTS OF THE QUESTIONNAIRE WERE ANALYZED TO DETERMINE THE EFFECT OF FOUR TYPICAL SEWER CHARGE METHODS ON THE ALLOCATION OF COSTS TO INDUSTRIAL FIRMS GENERATING VARYING VOLUMES OF WASTE WATER AND BOD. IT WAS SUGGESTED THAT PROBABLY THE MOST EQUITABLE ARRANGEMENT WAS THAT IN WHICH A PART OF THE REVENUES WAS OBTAINED BY CHARGES BASED ON BOD, SUSPENDED SOLIDS, AND VOLUME OF WASTES DISCHARGE TO THE SEWER AND ANOTHER PORTION AND CIVIC PROMOTIONAL GROUPS SHOULD BE SOLICITED IN DRAWING UP AN INDUSTRIAL SEWER SERVICE CHARGE PROGRAM. (W70-07470).

00753. THREE YEARS OPERATION OF AERATED STABILIZATION BASINS FOR PAPERBOARD MILL EFFLUENT.

HAYNES, F.D.
PROCEEDINGS OF THE INDUSTRIAL WASTE CONFERENCE, 23RD, PURDUE UNIVERSITY, P 361-373, 1968.

BECAUSE OF PROBLEMS CAUSED BY OVERLOADING, THE WASTE STABILIZATION PONDS OF PACKAGING CORPORATION OF AMERICA WERE CONVERTED TO AERATED STABILIZATION BASINS. THE TREATMENT NOW CONSISTS OF SCREENING AND PRIMARY SETTLING, AERATED LAGOONS FOLLOWED BY SETTLING LAGOONS AND POST AERATION BEFORE DISCHARGE. NINETY PERCENT OF THE SS AND 25 PERCENT OF THE BOD WERE REMOVED IN PRIMARY TREATMENT. WITH AN ELEVEN DAY DETENTION TIME, THE BOD WAS REDUCED FROM 468 MG/L TO 69 MG/L AND SUSPENDED SOLIDS WERE REDUCED FROM 3.2 LB/MG TO 2.0 LB/MG IN THE AERATION BASINS ON THE AVERAGE. THE SETTLING LAGOONS FURTHER REDUCED THE BOD AND SS TO 63 MG/L AND 1.1 LB/MG RESPECTIVELY. THE FINAL DISCHARGE, FOLLOWING POST AERATION, CONTAINED AN AVERAGE OF 56 MG/L BOD, 3.8 MG/L DO AND 1.9 LB/MG SUSPENDED SOLIDS. DURING THE THREE YEARS OF OPERATION, BOD REDUCTION RANGED 69 TO 95 PERCENT. ALTHOUGH SAMPLING SHOWED LITTLE VARIATION OF BOD, DO, OR SS WITHIN AN AERATION BASIN, AN ESTIMATED 720 TONS OF SLUDGE ACCUMULATED IN THE AERATION BASINS DURING 1967. THE EFFECT OF TEMPERATURE VARIATION AND NUTRIENT ADDITION IS ALSO DISCUSSED. THE COST OF OPERATION INCLUDING NUTRIENTS AND LABOR BUT EXCLUDING TAXES AND AMORTIZATION WAS 6.4 CENT/MG IN 1967. (W70-07478).

00754. LONG-TERM AERATION OF KRAFT PULP AND PAPER MILL WASTES.

WHITE, M.T.
PROCEEDINGS OF THE INDUSTRIAL WASTE CONFERENCE, 23RD, PURDUE UNIVERSITY, P.

THE RIEGELWOOD PAPER MILL ORIGINALLY PRODUCED 200 TONS/DAY OF BLEACHED KRAFT PULP. THE ORIGINAL WASTE TREATMENT FACILITIES CONSISTED OF A 230 ACRE RETENTION BASIN THAT PERMITTED STORAGE OR THE 14 MGD OF WASTE FOR 39 DAYS. THE BASIN PROVIDED SATISFACTORY TREATMENT FOR ONLY A SHORT TIME, AS THE PRODUCTION RATE OF THE MILL HAS INCREASED CONTINUOUSLY SINCE ITS INITIATION. STREAM STANDARDS FOR THE CAPE FEAR RIVER REQUIRE A MINIMUM DO OF 3.0 MG/L. A PILOT PLANT WAS INSTALLED TO EVALUATE THE TREATABILITY OF THE MILL WASTES WITH SUPPLEMENTAL SURFACE AERATION. BIOCHEMICAL OXYGEN DEMAND (BOD) REMOVAL OF 84 PERCENT WAS POSSIBLE WITH THE PILOT PLANT AND LABORATORY DETERMINATIONS INDICATED THAT THE WASTE HAD AN ALPHA VALUE OF 0.7, WHICH WAS USED IN DESIGNING THE TREATMENT SYSTEM. FOURTEEN 60 HP AERATORS WERE INSTALLED AND ACHIEVED AN 88 PERCENT BOD

REMOVAL EFFICIENCY DURING THE SUMMER-FALL PERIOD. THE AERATORS ARE NOT OPERATED DURING THE WINTER MONTHS, WHEN RIVER OXYGEN RESOURCES ARE SUFFICIENT TO ASSIMILATE THE TOTAL WASTE LOAD WITHOUT TREATMENT. THE TOTAL COST OF THE SURFACE AERATION SYSTEM WAS $260,000 AND THE ANNUAL OPERATING COSTS ARE ABOUT $56,000. THE TOTAL COST OF ALL EQUIPMENT INSTALLED TO DATE FOR MONITORING AND TREATING THE MILL WASTE IS A LITTLE OVER ONE AND A QUARTER MILLION DOLLARS. SINCE THE INSTALLATION OF THE AERATOR SYSTEM, THERE HAS BEEN A GRADUAL INCREASE IN MILL PRODUCTION WHICH HAS INCREASED THE VOLUME OF WASTE TO ABOUT 40 MGD. FIFTEEN 20 HP AERATORS WERE INSTALLED TO EXTEND THE AERATION TIME. THROUGH THE USE OF ADDITIONAL AERATORS, THE BASIN IS EXPECTED TO PROVIDE ADEQUATE TREATMENT FOR A WASTE VOLUME UP TO 100 MGD. (W70-07481).

00755. RECOVERY AND REUSE OF OIL EXTRACTED FROM INDUSTRIAL WASTE WATER.

SCHUTT, G.J.; KEIL, C.C.; HOLASZ, S.J.
PROCEEDINGS OF THE INDUSTRIAL WASTE CONFERENCE, 23RD, PURDUE UNIVERSITY, P 493-496, 1968.

TWO INDUSTRIAL WASTE TREATMENT PLANTS ARE MAINTAINED TO TREAT THE PROCESS WASTES OF THE TWO CLEVELAND ENGINE PLANTS OF THE FORD MOTOR COMPANY. THE OUTPUT OF THESE TREATMENT PLANTS CONSISTS OF CLARIFIED WATER, SLUDGE SLURRY, AND SKIM OIL. THE SKIM OIL CONTAINED 70% WATER, AND THE MAJOR COST OF DISPOSAL WAS HAULING IT AWAY. EXPERIMENTATION WITH A COMMERCIAL DE-EMULSIFYING AGENT RESULTED IN COMPLETE SEPARATION OF THE EMULSIFIED OIL AND WATER MIXTURE. THE OIL RECOVERED WAS OF SUCH GOOD QUALITY THAT IT WAS REUSED AS A SOLUBLE EMULSIFIED CUTTING OIL IN THE ENGINE PLANTS. COSTS OF CUTTING OIL COULD BE REDUCED FROM $0.90/GAL TO $0.16/GAL BY REUSE OF THE SKIM OIL. RECLAIMED OIL BASE COOLANTS LAST 40-50% LONGER THAN VIRGIN OIL BASE COOLANTS. CORROSION INHIBITION IS BETTER ALSO. MACHINERY STAYS CLEANER WITH RECLAIMED OIL. NEW FACILITIES BEING BUILT WILL SUPPLY THE FULL SOLUBLE OIL BASE DEMAND FOR BOTH ENGINE PLANTS. IN THE FACILITIES SOLIDS WILL BE REMOVED BY FILTRATION, RATHER THAN GRAVITY SETTLING AS WAS THE CASE IN THE PILOT PLANT STUDY. (W70-07485).

00756. POULTRY PROCESSING WASTES TREATMENT EXPERIENCE IN AERATED PONDS.

GRIFFITH, C.C.
PROCEEDINGS OF THE INDUSTRIAL WASTE CONFERENCE, 23RD, PURDUE UNIVERSITY, P 537-539, 1968.

THE POULTRY WASTE EMANATING FROM THE STERLING PROCESSING CORPORATION OF OAKLAND, MARYLAND, IS TREATED IN TWO AERATED PONDS IN SERIES. PRODUCTION IS SEASONAL, BEING DOUBLE IN THE FALL. DAILY PRODUCTION IN THE FALL IS APPROXIMATELY 200,000 LBS LIVE WEIGHT PER DAY WITH A BOD LOADING OF 1600 LBS PER DAY AVERAGE MAXIMUM AND 1900 LBS PER DAY PEAK MAXIMUM. AERATION IS SUPPLIED BY POSITIVE DISPLACEMENT BLOWERS DISCHARGING THROUGH FIXED CIRCULATORS IN THE TWO PONDS. WASTE WATER CIRCULATES AT 1 FPS AND HAS AN AVERAGE RETENTION TIME OF 14 HOURS. BIOCHEMICAL OXYGEN DEMAND (BOD) IN THE FIRST POND IS REDUCED FROM AN INFLUENT CONCENTRATION OF 800-1000 MG/L TO 70-100 MG/L, AND TO LESS THAN 30 MG/L IN THE SECOND POND. SUSPENDED SOLIDS AND COD REDUCTION ARE COMMENSURATE WITH BOD REDUCTION. E. COLI (MPN)WAS REDUCED IN EXCESS OF 99.9% AT A CHLORINE DOSAGE OF 20 LBS PER DAY. STERLING PROCESSING'S WASTE LOAD ACCOUNTS FOR ABOUT 60% OF THE TOTAL WASTE LOAD WITHIN THE GARRETT COUNTY SANITARY DISTRICT. ORIGINAL PLANS CALLED FOR AN ACTIVATED SLUDGE UNIT TO TREAT THE WASTES FROM THREE COMMUNITIES AND STERLING, WITH STERLING PAYING $194,000 OF THE $690,000 TOTAL COST, AND AN OPERATING COST OF $14,000/YR. VOTERS IN THE DISTRICT REJECTED THE FACILITY, AND STERLING WAS FORCED TO BUILD ITS OWN FACILITIES AT A COST OF $84,000, FOR A SAVINGS OF $109,000. (W70-07488).

00757. APPLICATION OF COMPUTERIZED ANALYSIS TO COMPARATIVE COSTS OF SLUDGE DEWATERING BY VACUUM FILTER AND CENTRIFUGE.

QUIRK, T.P.
PROCEEDINGS OF THE INDUSTRIAL WASTE CONFERENCE, 23RD, PURDUE UNIVERSITY, P 691-709, 1968.

ANALYSES ARE PRESENTED WHICH RECOGNIZE THE INTERMEDIATE NATURE OF THE DEWATERING OPERATION AND PROVIDE FOR ACCEPTANCE OF THE VARIOUS LIMITATIONS AND CONTROLS IMPOSED BY UPSTREAM PRETREATMENT AND DOWNSTREAM FINAL DISPOSAL. SYSTEM ANALYSIS APPROACH IS TAKEN TO ALLOW FOR BOTH GENERALIZATION AND SPECIFICITY NEEDS TO BE SERVED. COMPARISON BETWEEN CENTRIFUGE AND VACUUM FILTER COSTS IS MADE BASED ON SYSTEM ANALYSIS PROCEDURE FOR BOTH GENERAL AND SPECIFIC INSTALLATIONS. THE PROCEDURE EMPLOYED INVOLVES THE FOLLOWING STEPS: (1) DEVELOPMENT OF PERFORMANCE MODEL FOR THE UNIT OPERATION AND/OR THE EQUIPMENT UNDER STUDY, (2) USE OF FIELD PERFORMANCE DATA TO DEFINE THE CONSTANTS IN THE PERFORMANCE MODEL, (3) DEVELOPMENT OF A COST MODEL FOR THE UNIT OPERATION AND/OR EQUIPMENT UNDER STUDY, (4) RELATION OF COST OF PERFORMANCE AND, (5) USE OF COMPUTER FACILITIES TO EXECUTE THE COST OF PERFORMANCE RELATIONSHIP FOR ANY CONDITION DESIRED. COMPARATIVE COST ANALYSIS FOR A CONTINUOUS SLUDGE PRODUCTION RATE OF 750 LB/HOUR FOR THE CASE STUDIED FAVORS THE CENTRIFUGAL DEWATERING. (W70-07494).

00758. DECISION FACTORS--SEPARATE INDUSTRY OR JOINT MUNICIPAL WASTE TREATMENT.

SANDERS, F.A.
PROCEEDINGS OF THE INDUSTRIAL WASTE CONFERENCE, 23RD, PURDUE UNIVERSITY, P 1021-1028, 1968.

THE ADVANTAGES AND DISADVANTAGES ARE DISCUSSED TO BOTH INDUSTRY AND COMMUNITIES CONCERNING THE QUESTION OF WHETHER AN INDUSTRY SHOULD TREAT ITS OWN WASTES OR SEND THEM TO A COMMUNITY SEWAGE SYSTEM. THERE ARE DEFINITE ECONOMICAL ADVANTAGES TO INDUSTRY IN THE LATTER CASE, SINCE CAPITAL AND OPERATING COSTS CAN BE ELIMINATED AS AN INDUSTRY EXPENSE FOR THE WASTE FACILITIES CONSTRUCTED AND OPERATED BY THE COMMUNITY. GOOD RELATIONS ARE MAINTAINED WHEN AGREEMENTS CAN BE REACHED TO THE SATISFACTION OF THE COMMUNITY AND INDUSTRY. VARIOUS FACTORS WHICH PLAY A VERY IMPORTANT PART IN MAKING THE DECISIONS ARE DISCUSSED. THESE INCLUDE AVAILABILITY OF LAND FOR INDUSTRIES TO BUILD TREATMENT FACILITIES, TYPE OF WASTES, PRETREATMENT REQUIREMENTS, THE AMENABILITY OF INDUSTRIAL WASTES TO BIOLOGICAL TREAT-

MENT, TOXICITY, EFFECT OF CERTAIN WASTES UPON SEWER MATERIAL AND THE DISTANCE OF THE INDUSTRY FROM COMMUNITY TREATMENT PLANTS. FURTHER THE METHOD OF FINANCING, STATUES, LAWS, LEGAL IMPLICATIONS, AND EQUITABLE SERVICE CHARGES SHOULD ALL BE CONSIDERED IN MAKING THE FINAL DECISION. (W70-07502).

00759. ECONOMICS OF ARTIFICIAL RECHARGE FOR MUNICIPAL WATER SUPPLY.

FRANKEL, R.J.

ARTIFICIAL RECHARGE AND MANAGEMENT OF AQUIFERS, SYMPOSIUM OF HAIFA, MARCH 19-26, 1967, INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY, PUBLICATION NO 72, P 289-301, 1967.

A RESEARCH PROJECT WAS UNDERTAKEN TO DETERMINE WHETHER OR NOT WASTE RECLAMATION COULD BE ECONOMICALLY COMPETITIVE WITH OTHER WATER SOURCES FOR MUNICIPAL WATER SUPPLY. NUMEROUS ADVANCED WASTE TREATMENT SYSTEMS AND RECYCLE SCHEMES WERE EVALUATED. WASTE-WATER RENOVATION THROUGH GROUNDWATER RECHARGE PROVED TO BE THE MOST FEASIBLE SOLUTION TO RECLAMATION OF THE EFFLUENT OF ANY TYPE TREATMENT PLANT TODAY. FURTHER STUDY HAS EVALUATED THE CHEMICAL AND PHYSICAL LIMITATIONS OF ARTIFICIAL RECHARGE USING MUNICIPAL WASTES; THE ECONOMIC TRADE-OFFS BETWEEN ADDITIONAL TREATMENT PRIOR TO RECHARGE AND GREATER LAND UTILIZATION; AND THE BREAK-EVEN POINT FOR LAND VALUES AS A FUNCTION OF ECONOMICS OF SCALE. FINALLY THE ECONOMICSOF A PARTICULAR CASE-STUDY IN THE ARID WEST OF THE UNITED STATES IS DISCUSSED ASWELL AS PROPOSED SCHEME FOR CONVERTING THE NATION'S CAPITAL, WASHINGTON, D. C., IN THE HUMID EAST FROM USING SOLELY SURFACE WATER SUPPLIES TO USING ARTIFICIAL RECHARGE OF UNDEVELOPED AQUIFERS FOR FUTURE EXPANSION OF WATER SUPPLIES. (W70-04614).

00760. MATHEMATICAL MODEL OF TERTIARY TREATMENT BY LIME ADDITION.

SEIDEN, L.; PATEL, K.

ROBERT A. TAFT WATER RESEARCH CENTER REPORT NO TWRC-14, FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, SEPTEMBER 1969.69 P.

THE STATUS OF PHOSPHORUS REMOVAL FROM SECONDARY EFFLUENTS BY LIME ADDITION IS PRESENTED. BASED ON THE EMPIRICAL INFORMATION AVAILABLE, A MATHEMATICAL MODEL OF THE PROCESS WAS DEVELOPED. THE FACTOR WHICH BEST CORRELATED WITH PHOSPHORUS REMOVAL WAS THE PH OF THE TERTIARY EFFLUENT. COST INFORMATION FOR THE MODEL WAS GENERATED BASED ON A SOLIDS-CONTACT TYPE PRECIPITATOR SUCH AS THE INFILCO DENSATOR. A COMPUTER PROGRAM, IN FORTRAN IV, DERIVED FROM THE MODEL, WAS DEVELOPED FOR USE AS A SUBROUTINE IN THE FWPCA EXECUTIVE CALLING PROGRAM. GIVEN THE INPUT STREAM FLOW RATE AND ANALYSES, AND THE FINAL PH, THE PROGRAM COMPUTES THE NECESSARY DOSES OF LIME AND COAGULANT, THEIR COSTS, THE SIZE AND COST OF THE EQUIPMENT, THE DEGREE OF PHOSPHORUS REMOVAL, AND THE OUTPUT STREAM ANALYSES. (PB-190 170) (W70-04547).

00761. APPRAISAL OF GRANULAR CARBON CONTACTING: PHASE 1. EVALUATION OF THE LITERATURE. PHASE 2. ECONOMIC EFFECT OF DESIGN VARIABLES. PHASE 3. ENGINEERING DESIGN.

COVER, A.E.; PIERONI, L.J.; WOOD, C.D.

ROBERT A. TAFT WATER RESEARCH CENTER REPORT NO TWRC-12, FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, MAY 1969. 109 P.

A LITERATURE REVIEW OF TERTIARY WASTE WATER TREATMENT GIVES SPECIAL ATTENTION TO ACTIVATED CARBON ADSORPTION OF CHEMICAL OXYGEN DEMAND (COD), ALLOWABLE CAPACITY (LOADING) OF CARBON WITH ORGANIC WASTE MATTER, CARBON PARTICLE SIZE, AND NUMBER OF REGENERATION CYCLES ON ADSORPTION CAPACITY AND RATE. THE ECONOMIC EFFECTS OF SHOP FABRICATION AND FIELD ERECTION OF VESSELS, SURGE DESIGNS, PLANT SIZE, IDLE CARBON INVENTORY, VELOCITY, CONTACT TIME, PARTICLE SIZE, REGENERATION LOSS, CARBON CAPACITY, MATERIAL COSTS, NUMBER OF CONTACTING STAGES, AND IN-PLACE REGENERATION ARE DISCUSSED. MOST OF THE DATA WERE COLLECTED FROM CARBON TREATMENT PLANTS AT POMONA (CALIFORNIA), LAKE TAHOE (CALIFORNIA), NITRO (WEST VIRGINIA), WASHINGTON (NEW JERSEY), AND LEBANON (OHIO). RECOMMENDATIONS ARE MADE FOR FURTHER EVALUATION AND EXPERIMENTAL WORK. (PB-190 168) (W70-04548).

00762. THE OPERATION OF SALT WATER DISPOSAL SYSTEMS.

ABBOTT, W.G.

SOUTHWESTERN PETROLEUM SHORT COURSE, 13TH ANN., PROC.: LUBBOCK, TEX., TEXAS TECH., DEPT. PETROLEUM ENG., 141-143, 1966.

RICE ENGINEERING AND OPERATING, INC., HAS DESIGNED AND NOW OPERATES 9 COOPERATIVE SALT WATER DISPOSAL SYSTEMS IN THE W. TEXAS AND NEW MEXICO AREA. THESE SYSTEMS HANDLE PRODUCED BRINE FROM 2,900 WELLS THROUGH ABOUT 260 MILES OF GATHERING LINE INTO 20 DISPOSAL WELLS. THE VOLUME OF WATER DISPOSED DAILY INTO THESE WELLS IS OVER 100,000 BBL. IT IS NECESSARY TO INJECT THIS WATER BY PRESSURE PUMPS IN ONLY 3 OF THESE 20 WELLS. THE REMAINING 17 WELLS TAKE WATER BY GRAVITY FLOW WITH A VACUUM SHOWING ON THE TUBING GAGE UNDER USUAL OPERATING CONDITIONS. THE COST PER WELL FOR DISPOSAL AVERAGES APPROXIMATELY $1,700 FOR THESE 9 SYSTEMS. THIS INCLUDES ALL COSTS SUCH AS CONSTRUCTION OF GATHERING LINES, THE DRILLING OR WORKOVER OF DISPOSAL WELLS, THE PURCHASE OF NECESSARY RIGHT-OF-WAY, AND ALL ENGINEERING FEES. THE DISPOSAL WELLS DISCUSSED HEREIN RANGE IN TOTAL DEPTH FROM 4,753 TO 13,837 FT AND ARE ALL COMPLETED IN A LIMESTONE OR DOLOMITE FORMATION. ALL OF THE DISPOSAL WELLS ARE EQUIPPED WITH INJECTION TUBING THAT HAS BEEN INTERNALLY PLASTIC COATED. TO PROTECT THE EXTERIOR OF THE TUBING AND THE INTERIOR OF THE CASING FROM CORROSION AN 'OIL-BALANCE' METHOD IS USED

00763. DEEP WELL INJECTION IS EFFECTIVE FOR WASTE DISPOSAL.

ENVIR.SCI. & TECHNOL., 2(6), 406-410, 1968.

00764. INJECTION WELL INCORPORATES MANY SAFEGUARDS.

GROUND WATER AGE, 2(10), 34-37, 1968.

00765. REPLENISHING THE AQUIFER WITH TREATED SEWAGE EFFLUENT.

GROUND WATER AGE, 2(8), 30-35, 1968.

DEEP WELL DISPOSAL OF SELECTED INDUSTRIAL WASTES HAS BEEN PROVED FEASIBLE AND ACCEPTABLE IN THE NEW ORLEANS AREA BY SEVERAL INDUSTRIES INCLUDING SHELL OIL COMPANY'S NORCO REFINERY AND CHEMICAL PLANT WHERE THREE OF THE SIX SUCCESSFUL DISPOSAL WELLS IN THIS AREA ARE OPERATING. WELL DESIGN AND PROCEDURES FOR RESTORATION OF CAPACITY ARE BASED, IN MOST CASES, ON THE PRINCIPLES OF BRINE INJECTION DEVELOPED BY OIL PRODUCERS IN SOUTH LOUISIANA. GEOLOGICAL FORMATIONS IN THE GULF COAST AREA ARE SUITED TO THIS TYPE OF INJECTION BECAUSE RECEIVING STRATA ARE POROUS, ISOLATED FROM SOURCES OF POTABLE WATER AND THEIR WATER IS COMPATIBLE WITH THE LIQUID WASTES TO BE INJECTED. THIS METHOD OF DISPOSAL IS A SIMPLE, COMPLETE AND ECONOMICAL SOLUTION TO THE PROBLEMS PRESENTED BY CERTAIN HARD-TO-TREAT WASTES.

00766. PRODUCTION WORK GOES UNDERGROUND AT HOLLAND-SUCO.

CIVIL ENGINEERING, 36(5), P 92, 1966.

SOME 36,000 GPD OF WASTE FROM THE PRODUCTION OF COLOR PIGMENT WILL BE PUMPED INTO A POROUS SANDSTONE THROUGH A 5,896-FT DEEP WELL AT THE HOLLAND-SUCO COLOR CO. (A CHEMETRON CORP. SUBSIDIARY) PLANT IN HOLLAND, MICH. THE DEEP WELL COST $100,000 AND ELIMINATES THE NEED FOR EXPENSIVE NEUTRALIZATION OF WASTE PRIOR TO DISPOSAL. THE MICHIGAN STATE WATER RESOURCE COMMISSION IS SATISFIED WITH THE SAFEGUARDS AGAINST CONTAMINATION OF GROUND AND SURFACE WATERS. THE DETAILS OF WELL CONSTRUCTION AND PREINJECTION WASTE TREATMENT ARE DESCRIBED.

00767. COMPILATION AND ANALYSIS OF WASTE DISPOSAL INFORMATION.

ARNOLD, E.D.
OAK RIDGE NATIONAL LAB., TENN, CF-57-2-20, 295 P, 1957.

A SUMMARY OF WASTE PROCESSING, TREATMENT, AND DISPOSAL INFORMATION AS EXTRACTED FROM MANY DOCUMENTS ON THE VARIOUS ASPECTS OF THE GENERAL PROBLEM IS MEASURED. THE MATERIAL IN THIS REPORT IS INTENDED TO SERVE AS BACKGROUND FOR A PROGRAM PROPOSAL AT ORNL COVERING WASTE PROCESSING FOR FISSION PRODUCT RECOVERY, WASTE TREATMENT AND HANDLING, AND ULTIMATE DISPOSAL OF HIGH-LEVEL, INTERMEDIATE-LEVEL, AND LOW-LEVEL RADIOACTIVE WASTES. IN ADDITION TO AN INTRODUCTION TO THE COMPLEX OF PROBLEMS IN WASTE TREATMENT AND HANDLING, A SUMMARY OF VARIOUS ULTIMATE DISPOSAL SCHEMES, AND RELATED STUDIES, THE REPORT CATALOGS INFORMATION PAPERS ON PHASES OF: WASTE SOLUTION CHARACTERISTICS; ECONOMICS; PREDICTIONS OF ACTIVITY AND VOLUME BUILDUP IN A NUCLEAR POWER ECONOMY; POTENTIAL HEALTH HAZARDS OF FISSION AND TRANSMUTATION PRODUCTS; WASTE STORAGE, DECAY, AND SHIPMENT PRIOR TO ULTIMATE DISPOSAL; FISSION PRODUCT RECOVERY PROCESSES AND UTILIZATION; TREATMENT AND DISPOSAL OF INTERMEDIATE- AND LOW-LEVEL WASTES; REVIEWS OF ENGINEERING STUDIES OF PROBLEMS AT EXISTING PROCESSING PLANT WASTE DISPOSAL SALT-DOMES, UNDERGROUND FORMATIONS, AND THE OCEAN; SELF-SINTERING AT ELEVATED TEMPERATURES AS A METHOD OF ULTIMATE DISPOSAL; AND A MASTER REFERENCE LIST OF PERTINENT DOCUMENTS.

00768. WASTE MANAGEMENT ACTIVITIES IN THE ATOMIC ENERGY COMMISSION.

BELTER, W.G.
GROUND WATER, 1(1), 17-24, 1963.

THE VARIETIES OF RADIOACTIVE WASTES ARE CATEGORIZED IN A GENERAL WAY ON THE BASIS OF THEIR HAZARD POTENTIAL TO EMPHASIZE THAT THE PROBLEM OF RADIOACTIVE WASTE MANAGEMENT HAS NUMEROUS FACETS AND IS NOT AMENABLE TO A SINGLE, UNIVERSAL SOLUTION. THE ROLE OF SPECIFIC ENVIRONMENTS IN WASTE DISPOSAL PRACTICES IS SUMMARIZED AND THE BASIC APPROACHES ('DILUTE AND DISPERSE' AND 'CONCENTRATE AND CONTAIN') TO EFFLUENT CONTROL ARE DEFINED. DISTINCTION IS MADE BETWEEN BASIC RADIATION PROTECTION STANDARDS OR GUIDES, AND OPERATING OR PERFORMANCE CRITERIA THAT MUST BE ESTABLISHED IN CONNECTION WITH EFFLUENT CONTROL OPERATIONS IN ORDER TO ASSURE THE PROTECTION OF PUBLIC HEALTH AND SAFETY. EXAMPLES OF RADIOACTIVE WASTE DISPOSAL PRACTICE AND EXPERIENCE IN THE UNITED STATES FOR DIFFERENT TYPES OF WASTES ARE DESCRIBED AND TENTATIVE CONCLUSIONS ARE DRAWN REGARDING THE CAPABILITIES AND LIMITATIONS OF THESE PRACTICES. THE SCOPE AND OBJECTIVES OF THE RESEARCH AND DEVELOPMENT PROGRAM IN THIS FIELD ARE SUMMARIZED. THE STATUS OF WORK IN MAJOR WASTE DISPOSAL DEVELOPMENT PROJECTS IS NOTED. ECONOMIC FACTORS RELATED TO HANDLING AND DISPOSAL OF RADIOACTIVE WASTES ARE NOTED, INCLUDING RELATION OF NUCLEAR PLANT LOCATION TO DISPOSAL REQUIREMENTS. IT IS POINTED OUT THAT, ALTHOUGH TOTAL COSTS FOR TREATMENT AND DISPOSAL ARE SUBSTANTIAL, THE COST PER UNIT OF ELECTRICAL ENERGY PRODUCED IS A RATHER SMALL PERCENTAGE OF THE TOTAL COST PER UNIT OF ENERGY.

00769. THE FEASIBILITY OF DEEP WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS.

BOEGLY, W.J. JR; JACOBS, D.G.; LOMENICK, T.F.
OAK RIDGE NATIONAL LAB., TENN., 84 P, 1969. (PB-203 852.

DEEP-WELL INJECTION WAS PROPOSED AS A METHOD FOR DISPOSAL OF BRINE EFFLUENTS FROM INLAND DESALTING PLANTS. A REVIEW OF PERTINENT LITERATURE REVEALS THAT DEEP-WELL INJECTION IS TECHNICALLY FEASIBLE, IF SATISFACTORY PRETREATMENT IS PROVIDED. INDUSTRIAL WASTE CAN BE DISPOSED OF IN THIS MANNER FOR ABOUT $1.00 TO $2.00 PER 1000 GALLONS. BRINE DISPOSAL FROM OIL-FIELD OPERATIONS IS LESS COSTLY, RANGING FROM $0.25 TO $0.70 PER 1000 GALLONS PRIMARILY BECAUSE OF THE MAGNITUDE OF THE OPERATION AND BECAUSE LESS EXTENSIVE PRETREATMENT IS REQUIRED. IN ORDER TO PREVENT DAMAGE TO THE RECEIVING FORMATION, IT WILL BE NECESSARY TO INJECT WASTE SOLUTION WITHOUT PLUGGING THE FORMATION. THIS REQUIRES THAT THE SOLUTION BE FREE OF SUSPENDED

SOLIDS AND BE CHEMICALLY STABLE WITH REGARD TO FORMATION OF PRECIPITATES. TREATMENT MAY ALSO BE REQUIRED TO PREVENT BIOLOGICAL GROWTHS THAT CAN PLUG THE INJECTION FACE. A SUITABLE SITE FOR DEEP-WELL INJECTION REQUIRES A PERMEABLE SEDIMENTARY FORMATION, SUCH AS SANDSTONE OR LIMESTONE, CAPPED BY AN IMPERMEABLE FORMATION, SUCH AS SHALE, TO PREVENT POLLUTION OF NEIGHBORING POTABLE WATERS. SUCH SEQUENCES OF FORMATIONS ARE MOST LIKELY TO BE SITUATED IN THE CLOSED BASINS, BUT SUITABLE SITES MAY BE FOUND THROUGHOUT WIDE GEOGRAPHIC AREAS OF THE COUNTRY. EVEN WHEN PRELIMINARY SCREENING SUGGESTS THAT THE GENERAL AREA IS HIGHLY FAVORABLE FOR DEEP-WELL INJECTION, MORE DETAILED GEOLOGIC AND HYDROLOGIC INVESTIGATIONS WILL BE REQUIRED TO ASSURE THAT THE SITE IS SATISFACTORY AND TO PROVIDE DATA TO BE USED AS THE BASIS FOR DESIGNING AN INJECTION SYSTEM.

00770. ARTIFICIAL RECHARGE AND MANAGEMENT OF AQUIFERS.

COHEN, P; DURFOR, C.N.
SYMPOSIUM OF HAIFA, MAR. 19-26, '67 INTERNATIONAL ASSN. OF SCIENTIFIC HYDROLOGY, PUBLICATION NO. 72, P 193-199, 1967.

THE U. S. GEOLOGICAL SURVEY, IN COOPERATION WITH THE NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS, IS CONDUCTING A SERIES OF ARTIFICIAL-RECHARGE EXPERIMENTS ON LONG ISLAND, N. Y. THE EXPERIMENTS ARE DESIGNED TO OBTAIN SCIENTIFIC AND ECONOMIC DATA NEEDED TO EVALUATE THE FEASIBILITY OF INJECTING HIGHLY TREATED SEWAGE-PLANT EFFLUENT INTO A PROPOSED NETWORK OF 'BARRIER' INJECTION WELLS THAT ARE INTENDED TO PREVENT OR RETARD THE LANDWARD MOVEMENT OF SALTY WATER FROM THE ATLANTIC OCEAN INTO MAJOR AQUIFERS BENEATH LONG ISLAND. A TERTIARY SEWAGE-TREATMENT PROCESS HAS BEEN DEVELOPED TO UPGRADE THE QUALITY OF THE EFFLUENT SO THAT IT MEETS THE REQUIREMENTS THAT ARE COMMONLY ACCEPTED FOR POTABILITY IN THE UNITED STATES. IN ADDITION, A UNIQUELY DESIGNED EXPERIMENTAL INJECTION WELL AND INJECTION PLANT HAVE BEEN COMPLETED. THE INJECTION-WELL COMPLEX, WHICH IS ABOUT 500 FEET DEEP, CONSISTS OF TWO ADJACENT FIBERGLASS CASINGS THAT SURMOUNT STAINLESS-STEEL SCREENS AND OF SEVEN AUXILIARY PLASTIC PIPES. THE CASINGS AND PIPES, EQUIPPED WITH REMOTE-SENSING DOWN-HOLE GEOCHEMICAL PROBES, PERMIT THE MEASUREMENT OF HYDRAULIC-HEAD CHANGES AND RELATED GEOCHEMICAL CHANGES AT SEVERAL POINTS WITHIN THE INJECTION WELL AND THE FILTERPACK. DATA FROM THE EXPERIMENTAL INJECTION WELL AND FROM 13 NEARBY OBSERVATION WELLS ARE PROVIDING INFORMATION REGARDING SEVERAL ASPECTS OF THE PROPOSED ARTIFICIAL RECHARGE, MOST NOTABLY: (1) THE DESIGN AND HYDRAULIC CHARACTERISTICS OF INJECTION WELLS, (2) HYDRAULICS OF THE LEAKY ARTESIAN AQUIFERS, AND (3) GEOCHEMICAL CONTROLS ON ARTIFICIAL GROUND-WATER RECHARGE THROUGH WELLS.

00771. RADIOACTIVE WASTE DISPOSAL BY HYDRAULIC FRACTURING.

DELAGUNA, W.
GROUND WATER, 6(6), P 47, 1968.

00772. THE DISPOSAL OF POWER REACTOR WASTE INTO DEEP WELLS.

DELAGUNA, W.; BLOMEKE, J.O.
OAK RIDGE NATIONAL LAB., TENN., CF-57-6-23, 18 P, 1957.

DISPOSAL OF WASTES FROM THE PROCESSING OF SOLID FUEL ELEMENTS AND FROM SOLID BLANKET ELEMENTS IS DISCUSSED. THE SUBJECTS CONSIDERED INCLUDE EXTRACTION OF URANIUM BY SEVERAL METHODS, THE REMOVAL OF ELEMENT JACKETS, THE TREATMENT OF URANIUM-ZIRCONIUM FUEL ELEMENTS, DISPOSAL INTO DEEP WELLS, THE HYDRAULICS OF WELLS, THERMAL CONSIDERATIONS OF DISPOSAL AQUIFERS, REGIONAL HYDROLOGY, POTENTIAL DEEP-WELL DISPOSAL AREAS IN THE U. S., AND THE COST OF DISPOSAL.

00773. ENGINEERING DEVELOPMENT OF HYDRAULIC FRACTURING AS A METHOD FOR PERMANENT DISPOSAL OF RADIOACTIVE WASTES.

DELAGUNA, W.; TAMURA, T.; WEEREN, H.O.; ST.
OAK RIDGE NATIONAL LAB., TENN., 261 P, AUG 1969.

THE DEVELOPMENT OF THE PROCESS TO DISPOSE OF RADIOACTIVE WASTE BY INJECTION IN THE EARTH IS DESCRIBED. SUBSEQUENT EXPERIMENTS ARE EXPLAINED. THE GEOLOGIC SETTING IN THE EXPERIMENTAL OAK RIDGE WASTE INJECTION AREA IS DESCRIBED. THE ENGINEERING DESIGN OF EQUIPMENT AND FACILITIES IS GIVEN.

00774. A METHOD OF HANDLING SALT WATER DISPOSAL INCLUDING TREATMENT OF WATER.

ELLISTON, H.W.; DAVIS, W.B.
OIL AND GAS JOUR. 43(4), 59-61, 1944.

A SURVEY OF 256 SALT-WATER DISPOSAL SYSTEMS HAVING AN INITIAL INVESTMENT OF $4,204,965.86 AND 86 SYSTEMS HAVING AN OPERATING COST OF $1,213,253.05 IS REPORTED. THE OPEN TYPE OF DISPOSAL SYSTEM GENERALLY INVOLVES THE STEPS OF: (1) AERATION, (2) COAGULATION, (3) SEDIMENTATION, AND (4) FILTRATION. IN SOME AREAS WHERE BACTERIA ARE THOUGHT TO BE AIDING IN PLUGGING LINES, CHLORINATION IS ALSO A STEP IN THE TREATING PROCESS. EACH OF THESE STEPS IS DISCUSSED BRIEFLY. THE CLOSED TYPE SYSTEM, SEMICLOSED SYSTEM AND STABILIZATION OF WATER ARE ALSO DISCUSSED BRIEFLY. PERTINENT DATA ON 22 SELECTED DISPOSAL SYSTEMS ARE TABULATED.

00775. UNDER THE RUG.

EVANS, D.M.; BRADFORD, A.
ENVIRONMENT, 11(8), 3-31, 1969.

RAPIDLY INCREASING NUMBERS OF INDUSTRIES AND GOVERNMENT AGENCIES ARE TAKING ADVANTAGE OF THE PRESENT GAP IN POLLUTION LAWS TO DUMP DIVERSE TYPES OF WASTE UNDERGROUND THROUGH INJECTION WELLS. ALTHOUGH PROPONENTS OF WASTE INJECTION WELLS SUGGEST THAT ONLY CONCENTRATED AND UN-

TREATABLE WASTES SHOULD BE INJECTED UNDERGROUND, MANY WASTES NOT IN EITHER CATEGORY ARE BEING PUMPED DOWN WELLS BECAUSE IT IS THE CHEAPEST MEANS OF DUMPING. ALTHOUGH THE CONCEPT OF DEEP-WELL INJECTION IS THEORETICALLY SOUND, THE REQUIRED GEOLOGICAL AND ENGINEERING CONDITIONS ARE PRACTICALLY NONEXISTENT. SEVERAL EXAMPLES ARE CITED TO SHOW THE KINDS OF PROBLEMS THAT CAN OCCUR WHEN WASTES ARE INJECTED UNDER PRESSURE INTO THE SUBSURFACE. SOME EXPERTS SUGGEST THAT MOST OF THE PROBLEMS CAN BE OVERCOME BY THE EXERCISE OF PROPER PRECAUTIONS AND ADVANCED TECHNOLOGY, BUT THE COST OF SUCH CAREFULLY MADE WELLS WOULD MAKE THEM LESS ATTRACTIVE TO OPERATORS THAN CHEAPER METHODS OF SURFACE TREATMENT.

00776. UNDERGROUND DISPOSAL OF INDUSTRIAL WASTE IN LOUISIANA.

GRAVES, B.S.

SOCIETY OF MINING ENGINEERS, PREPRINT NO. 64-H-315, 1964, 7 P.

DEEP WELL DISPOSAL OF SELECTED INDUSTRIAL WASTES HAS BEEN PROVED FEASIBLE AND ACCEPTABLE IN THE NEW ORLEANS AREA BY SEVERAL INDUSTRIES INCLUDING SHELL OIL COMPANY'S NORCO REFINERY AND CHEMICAL PLANT WHERE THREE OF THE SIX SUCCESSFUL DISPOSAL WELLS IN THIS AREA ARE OPERATING. WELL DESIGN AND PROCEDURES FOR RESTORATION OF CAPACITY ARE BASED, IN MOST CASES, ON THE PRINCIPLES OF BRINE INJECTION DEVELOPED BY OIL PRODUCERS IN SOUTH LOUISIANA. GEOLOGICAL FORMATIONS IN THE GULF COAST AREA ARE SUITED TO THIS TYPE INJECTION BECAUSE RECEIVING STRATA ARE POROUS, ISOLATED FROM SOURCES OF POTABLE WATER AND THEIR WATER IS COMPATIBLE WITH THE LIQUID WASTES TO BE INJECTED. THIS METHOD OF DISPOSAL IS A SIMPLE, COMPLETE AND ECONOMICAL SOLUTION TO THE PROBLEMS PRESENTED BY CERTAIN HARD-TO-TREAT WASTES.

00777. CONSERVATION OF FRESH-WATER RESOURCES BY DEEP WELL DISPOSAL OF LIQUID WASTES.

GRUBBS, D.M.; HAYNES, C.D.; TUCKER, W.E.

ALABAMA UNIVERSITY, 85 P, MAY 1973, (PB-194 112.

00778. DEEP WELL FLUID WASTE DISPOSAL.

HALLIGAN, E.G.

GROUND DISPOSAL OF RADIOACTIVE WASTES CONFERENCE, 2ND ATOMIC ENERGY OF CANADA LIMITED AND US AEC, CHALK RIVER, CANADA, PROC., BOOK 2: TID-7620, 363, 373, 1961.

THIS PAPER TRACES THE HISTORY OF EARLY OIL-FIELD BRINE DISPOSAL OPERATIONS AND DESCRIBES THE DEVELOPMENT OF CORROSION-RESISTING MATERIALS AND PRACTICES USED IN GATHERING AND INJECTING OIL-FIELD BRINES INTO DISPOSAL OR INPUT WELLS. THE FIVE METHODS GENERALLY USED TO MITIGATE CORROSION IN WATER FLOODS OR BRINE DISPOSAL SYSTEMS ARE (1) USE OF COATED OR NONMETALLIC PIPES AND EQUIPMENT, (2) CATHODIC PROTECTION OF EQUIPMENT, (3) USE OF CHEMICAL INHIBITORS, (4) TREATMENT TO CHANGE THE CHEMICAL PROPERTIES OF THE BRINE, AND (5) USE OF METALS THAT RESIST CORROSION. THE USE OF COATED OR NONMETALLIC EQUIPMENT IS THE MOST POPULAR, BUT ITS SUCCESS IS DEPENDENT ON THE QUALITY OF WORKMANSHIP IN THE MANUFACTURE OF THE EQUIPMENT. CONSTANT REPLACEMENT OF EQUIPMENT IS OFTEN THE RESULT OF INADEQUATE PLANNING FOR CORROSION PROTECTION. THIS IS EVIDENT IN THE OPERATION OF MANY DISPOSAL SYSTEMS WHERE LESS THOUGHT IS GIVEN TO CORROSION THAN IS GIVEN TO CHEMICAL TREATMENT TO AVOID FORMATION PLUGGING. SUCH EMPHASIS SEEMS IMPRACTICAL BECAUSE FORMATION PLUGGING IS GENERALLY LESS EXPENSIVE THAN COLLAPSED CASING CAUSED FROM CORROSION.

00779. DEEP WELL WASTE DISPOSAL AT MIDWEST STEEL.

HARTMAN, C.D.

IRON AND STEEL ENG., 43(12), 118-121, 1966.

DETAILS ARE GIVEN FOR THE CONSTRUCTION OF A DEEP WELL BELOW THE MIDWEST PLANT OF NATIONAL STEEL CORP. AT PORTAGE, IND., FOR SLUDGE DISPOSAL. THE WELL WENT INTO OPERATION IN FEBRUARY 1965 AND SINCE THEN 2.3 X 10.7 GALLONS OF ACID HAVE BEEN DISCHARGED INTO IT. THUS WASTE ELEMENTS ARE ELIMINATED BY STORING IN A SUITABLE UNDERGROUND FORMATION WHICH WILL RETAIN THE SOLUTIONS AND NOT GIVE RISE TO CONTAMINATION OF POTABLE WATER AND MINERAL RESOURCES. A DESCRIPTION OF THE PUMPING MECHANISM IS GIVEN AND COST COMPARISON OF THE INSTALLATION INDICATES A CONSIDERABLE SAVING OVER NORMAL METHODS OF DISPOSAL.

00780. DEEP WELL DISPOSAL OF STEEL MILL WASTES.

HARTMAN, C.D.

J. WATER POLLUTION CONTROL FED., 40(1), 95-100, 1968.

THE COST OF OPERATING WASTE TREATMENT FACILITIES AT THE MIDWEST STEEL MILL IN PORTAGE, IND., HAS BEEN SUBSTANTIALLY REDUCED BY THE USE OF DEEP WELLS TO DISPOSE OF WASTE PICKLE ACIDS. THE WELL IS FINISHED IN THE MOUNT SIMON SANDSTONE, A POROUS AND PERMEABLE WATER-FILLED SANDSTONE THAT OCCURS AT A DEPTH OF 1,900 FEET BENEATH THE MILL SITE AND HAS ADEQUATE SHALE COVER TO PREVENT VERTICAL MIGRATION. THE DETAILS OF WELL CONSTRUCTION INCLUDE THE USE OF ACID-RESISTANT CEMENT, FIBER-CAST INJECTION TUBING AND EXTERNAL PRESSURE AROUND THE INJECTION TUBE. NUMBER 6 FUEL OIL IS PUMPED INTO THE WELL TO PROTECT THE CEMENT SEAL AT THE TOP OF THE MOUNT SIMON SANDSTONE. ON COMPLETION OF THE WELL, 35 MILLION GALLONS OF FRESH WATER TREATED WITH BOTH CHLORINE AND A BIOCIDE WERE PUMPED INTO THE WELL TO PROVIDE A BUFFER ZONE BETWEEN THE INJECTED WASTE AND THE NATIVE WATER IN THE INJECTION ZONE. DURING THE FIRST 18 MONTHS OF OPERATION OF THE DEEP-WELL SYSTEM, SOME 23 MILLION GALLONS (87,000 CU M) OF ACID WASTE HAS BEEN INJECTED INTO THE MOUNT SIMON SANDSTONE WITH NO APPARENT CHANGE IN WELL-HEAD INJECTION PRESSURE. THE WASTE STREAM IS COMPOSED OF SULFURIC PICKLING ACID, SODIUM DICHROMATE, AND CHROMIC ACID SOLUTIONS. THE USE OF THE DEEP-WELL DISPOSAL METHOD HAS REDUCED THE ACCUMULATION OF SLUDGE BY 70 PERCENT AND VIRTUALLY ELIMINATED THE COST OF OPERATING THE LIME NEUTRALIZATION FACILITIES.

REFERENCE LIST

00781. A SYSTEM FOR THE EVALUATION OF LIQUID WASTE DISPOSAL.

HAWKINS, D.B.
US AEC COMM., IDAHO OPERATIONS OFFICE, 1966, 46 P, (IDO-12052.

A SYSTEM IS DISCUSSED WHICH ATTEMPTS TO COMBINE THE COST-HAZARD ASPECTS OF A WASTE-DISPOSAL OPERATION IN A LOGICAL AND USEFUL MANNER AND WHICH SHOWS PROMISE FOR THE EVALUATION OF A DYNAMIC WASTE DISPOSAL OPERATION IN A LOGICAL AND USEFUL MANNER AND WHICH SHOWS PROMISE FOR THE EVALUATION OF A DYNAMIC WASTE-DISPOSAL OPERATION. A TEST CASE IN WHICH WASTE IS DISCHARGED EITHER TO THE GROUND VIA A SEEPAGE POND OR TO THE WATER TABLE VIA A WELL WAS EVALUATED. IN THIS EXAMPLE, THE HAZARDS WERE APPRAISED; THE FIXED COSTS INCLUDING MONITORING COSTS WERE TABULATED; AND THE PROBABLE COSTS, I. E., THOSE COSTS WHICH ENSUE IF A GIVEN EVENT OCCURS, WERE EVALUATED USING ESTIMATES OF THE PROBABILITY OF OCCURRENCE OF VARIOUS HAZARDOUS EVENTS. THE PROBABILITY ESTIMATES WERE SUBJECTIVE ESTIMATES OF THE EVALUATOR WHO DREW UPON THE GEOLOGIC, HYDROLOGIC, AND CHEMICAL INFORMATION AVAILABLE. THE PROBABLE COSTS AND FIXED COSTS WERE TABULATED IN A STATISTICAL COST TABLE, WHICH WAS USED IN CONJUNCTION WITH THE HAZARD EVALUATION TO CHOOSE THE OPTIMUM METHOD OF DISPOSAL.

00782. SALT WATER DISPOSAL.

HOCHHAUSEN, E.
CANADIAN OIL AND GAS INDUSTRIES, 12(1), 79-80, 1959.

IN THE LAST TEN YEARS THE QUANTITY OF OIL FIELD BRINE PRODUCED IN ALBERTA (CANADA) HAS RISEN FROM A NEGLIGIBLE AMOUNT TO 1,500,000 BBL MONTHLY. WATER CONTAINING MORE THAN 1000 PPM OF DISSOLVED SALTS IS REGARDED AS SALINE IN ALBERTA, AND ALL SALINE WATER IS EITHER DISPOSED OF IN ALREADY CONTAMINATED AREAS, E. G., SALT BEDS, ALKALI LAKES, ETC., OR RETURNED TO SUBSURFACE SALT WATER BEARING FORMATIONS OR THE FORMATION FROM WHICH IT WAS PRODUCED. IN GENERAL, THE COST OF A GRAVITY SYSTEM FOR WELLS ON 40-ACRE SPACING WITH DISPOSAL CAPACITY FROM 150 TO 300 BBL OF WATER PER DAY WILL BE BETWEEN $2500 AND $3500 PER PRODUCING WELL. CORROSION IS A PROBLEM IN MAINTAINING A DISPOSAL WELL. WOODEN TANKS ARE GENERALLY THE MOST EFFICIENT SETTLING TANKS, AS STEEL TANKS ARE SUBJECT TO CORROSION, AND POURED CONCRETE PITS ARE MOST COSTLY AND DIFFICULT TO INSTALL. SEVERAL DIFFERENT MATERIALS AND ARRANGEMENTS ARE USED FOR GATHERING SYSTEMS.

00783. A DISPOSAL WELL FOR SPENT SULFURIC ACID FROM ALKYLATING ISO-BUTANE AND BUTYLENES.

HOLLAND, H.R.; CLARK, F.R.
IND. WASTE CONF., 19TH, LAFAYETTE, IND. PROC., PT. 1, 195-199, 1964.

THE PROBLEM OF DISPOSING OF 1,500 TONS PER YEAR OF SPENT SULFURIC ACID FROM A CALGARY, ALBERTA (CANADA), PLANT FOR THE ALKYLATION OF ISOBUTANE AND BUTYLENES WAS SOLVED BY THE CONVERSION OF A WELL IN AN ABANDONED OIL FIELD INTO A WASTE INJECTION WELL. THE WELL, WHICH IS LOCATED IN THE JOFFRE FIELD AT RED DEER ON THE EDMONTON HIGHWAY ABOUT 90 MILES NORTH OF CALGARY, HAD BEEN PLUGGED WITH CEMENT, BUT THE CASING HAD NOT BEEN PULLED, SO THAT RECONDITIONING WAS RELATIVELY CHEAP. PERMISSION TO USE THE WELL FOR THE DISPOSAL OF SPENT ACID AT A RATE NOT EXCEEDING 1,000 BARRELS PER MONTH WAS OBTAINED FROM THE ALBERTA OIL AND GAS CONSERVATION BOARD. THE CEMENT PLUG WAS DRILLED OUT TO A DEPTH OF 5,128 FT AND PERFORATED WITH FOUR SHOTS PER FOOT FROM 5,087 TO 5,103 FEET IN THE VIKING FORMATION. THE FIRST INJECTION OF SPENT ACID WAS MADE WITH HIGH PRESSURE PUMPS TO FRACTURE THE FORMATION. THE MAXIMUM WELL HEAD PRESSURE OBTAINED WAS 2,000 PSI AT A RATE OF OVER 200 BARRELS PER HOUR. SUBSEQUENTLY, A SATISFACTORY RATE OF INJECTION HAS BEEN OBTAINED WITH A CONSTANT PRESSURE OF 50 PSI. THE CHIEF VARIABLES IN THIS METHOD ARE THE COST OF THE WELL AND TRANSPORTATION OF THE WASTES. BY RECONDITIONING AN ABANDONED WELL AND MOVING THE SPENT ACID AT A BACKHAUL RATE IN THE TRUCKS WHICH CARRY FRESH ACID FROM EDMONTON TO CALGARY, TOTAL FIXED AND OPERATING COSTS ARE LESS THAN THE COST OF FUEL FOR INCINERATION.

00784. ECONOMIC PRINCIPLES OF LIABILITY AND FINANCIAL RESPONSIBILITY FOR OIL POLLUTION.

HOROWITZ, S.
CENTER FOR NAVAL ANALYSES, ARLINGTON, VA. REPT. NO. CNA-PROF. PAPER -56, 1971.

00785. SUBSURFACE DISPOSAL OF OIL FIELD BRINES.

JESSEN, F.W.
CHEM. ENG. PROG., 45(1), 11-16, 1949.

INJECTION OF OIL WELL BRINES INTO THE SUBSURFACE OF THE EAST TEXAS OIL FIELDS DISPOSES OF THE BRINES AND AT THE SAME TIME INCREASES OIL PRODUCTION. THE WATER IS INJECTED AT DEPTHS VARYING FROM A FEW HUNDRED TO 6,000 OR 7,000 FT. A HALF MILLION BBL/DAY ARE RETURNED, WHICH REPRESENTS ABOUT 90 PERCENT OF ALL THE WATER PRODUCED. AVERAGE SURFACE TREATING INSTALLATIONS IN THE EAST TEXAS AREA COST APPROX. $60,000 PLUS AN ADDITIONAL WELL COST OF $30,000. SUCH AN INSTALLATION CAN HANDLE 15,000 BBL/DAY OF SALT WATER. THE OVERALL INJECTION COST VARIES FROM 2 TO 3 MILLS TO 1-1/2 TO 2 CENTS PER BBL.

00786. SUBSURFACE BRINE DISPOSAL.

JONES, O.S.
OIL WEEKLY, 120(10), 27-29, 1946.

DEEP DISPOSAL OF OILFIELD BRINES IN DISPOSAL WELLS OF 4500 FT. OR MORE IS FAVORABLE TO BOTH CONSERVATION OF OIL AND GAS IN THE FIELD, AND THE PROTECTION OF FRESH WATER AND FARM LANDS IN THE AREA. AFTER SUITABLE TREATING, THE WATER MAY BE USEFUL IN THE FLOODING OF STRIPPER WELLS, GREATLY AIDING SECONDARY RECOVERY. IN A FIELD, A NUMBER OF OPERATORS MAY USE A COMMUNITY INPUT WELL, THUS REDUCING THE COST TO LESS THAN ONE CENT PER BBL OF BRINE. THE COOPERATION OF OPERATORS AND LANDOWNERS TO AID THIS SYSTEM OF WASTE DISPOSAL IS URGED.

00787. FEASIBILITY OF RETURNING SALT WATER.

KING. H.H.
OIL WEEKLY, 91(12), 23-24, 26, 28, 1938.

THE FEASIBILITY OF RETURNING SALT WATER TO THE FORMATION BY SPECIAL INPUT WELLS IS SHOWN ON THE BASIS OF THE EXAMPLE OF SUN OIL CO. OPERATING IN THE EAST TEXAS FIELDS. DATA ARE CITED ON INPUT WELLS AND OTHER EQUIPMENT, WITH EMPHASIS ON COST ACCOUNT, AND ILLUSTRATED BY DIAGRAMS AND GRAPHS.

00788. UNDERGROUND DISPOSAL OF SALT WATER.

LEE, M
OIL AND GAS J., 34(44), 41-44, 1936.

THIS PAPER DESCRIBES THE MEASURES TAKEN BY OIL COMPANIES IN KANSAS TO DISPOSE OF SALT WATER AND PRODUCTION WASTES IN SUCH A WAY AS TO AVOID DAMAGES TO OTHERS AND LOSSES TO THE PRODUCERS. LEGISLATION ENABLING THE PRODUCERS TO INJECT THEIR WASTES UNDERGROUND HAS OPENED THE WAY TO AVOID DAMAGE TO FRESH WATER RESOURCES AND TO INCREASE OIL PRODUCTION BY WATER-FLOODING TECHNIQUES. THE REGULATIONS, PROCEDURES, COSTS, AND BENEFITS ARE BRIEFLY DESCRIBED.

00789. SUBSURFACE DISPOSAL OF INDUSTRIAL WASTE WATER.

LOCKETT, D.E.
INDUSTRIAL WATER AND WASTE CONF., 7TH, TEXAS WATER POLL. CONTROL ASSN., JUNE 1, 2, 1967, TEXAS U., AUSTIN, TEX..

THIS PAPER DESCRIBES THE DEEP WELL SYSTEM THAT IS USED FOR THE DISPOSAL OF EXCESS INDUSTRIAL WASTE WATER AT THE PETRO-CHEMICAL COMPLEX NEAR ODESSA, TEX. THE INJECTION WELL IS 5,802 FEET DEEP. IT IS CASED TO A DEPTH OF 4,900 FEET AND FINISHED IN THE BRINE-SATURATED SAN ANDRES LIMESTONE. UPON COMPLETION, THE WELL WAS ACIDIZED TO IMPROVE ITS INJECTION CAPACITY. CORES AND BRINE SAMPLES FROM THE SAN ANDRES WERE USED TO EVALUATE THE COMPATIBILITY OF THE WASTE STREAM WITH THE INJECTION ZONE. DISPOSAL OF INDUSTRIAL WASTE-WATER ALTERNATES FROM SMALL DAILY INJECTIONS TO MAXIMUM RATES OF 33,000 BARRELS PER DAY AT 1,100 PSIG, DEPENDING ON DEMAND. ALTHOUGH THE SYSTEM IS SUCCESSFUL, IT HAS PROVEN TO BE EXPENSIVE--EQUIVALENT TO 2 CENTS PER BARREL.

00790. THE DESIGN AND OPERATION OF A PRIVATE WASTE DISPOSAL PLANT NEAR SARNIA, ONTARIO.

LOMBARD, W.K.
PROC., 24TH IND. WASTE CONF., PURDUE U. MAY 6-8, 1969, P 6-12.

00791. ACTIVITIES OF THE DIVISION OF RESEARCH AND STATISTICS.

FOURTEENTH BIENNIAL REPORT (1938-1969), LA.STATE DEPARTMENT OF CONSERVATION, 282-313, 1940.

AMONG THE TOPICS DEALT WITH IN THE 14TH BIENNIAL REPORT FOR 1938-39 OF THE LOUISIANA DEPT. OF CONSERVATION ARE: THE ACTIVITIES OF THE DIVISION OF RESEARCH AND STATISTICS IN PETROLEUM AND CHEMICAL ENGINEERING. THE OIL REFINERY POLLUTION PROBLEM IS NARROWED DOWN NOW TO THE TASK OF SEPARATING WASTE OIL FROM WASTE WATER AND DISPOSING THE OIL MATTER BY BURNING. OIL FIELD BRINE POLLUTION IS SECOND IN IMPORTANCE ONLY TO PULP WASTES. THE MOST SATISFACTORY METHOD OF ABATEMENT IS THE USE OF DRILLED WASTE DISPOSAL WELLS. THIS METHOD OF ABATEMENT IS THE USE OF DRILLED WASTE DISPOSAL WELLS. THIS METHOD REQUIRES A GREATER INITIAL EXPENDITURE DUE TO COST OF DRILLING, PUMPING EQUIPMENT, AND GATHERING SYSTEMS. IT REQUIRES CAREFUL SUPERVISION TO PREVENT CONTAMINATION OF FRESH WATER SANDS, AND IT USUALLY REQUIRES COMPLETE SEPARATION OF OIL AND WATER BEFORE DISPOSAL. ONE REFINERY HAS ADAPTED THIS METHOD TO THE REQUIREMENTS OF REFINERY WASTE DISPOSAL. AT PRESENT, THE 47 DISPOSAL WELLS IN LOUISIANA HANDLE ABOUT 140,000 BBLS. DAILY.

00792. DISPOSAL OF SPENT CAUSTIC AND PHENOLIC WATER IN DEEP WELLS.

MACLEOD, I.C.
ONTARIO INDUSTRIAL WASTE CONFERENCE, 8TH, 1961, PROC.: HONEY HARBOUR, ONT., ONTARIO WATER RESOURCES COMM., WATER AND POLLUTION ADVISORY COMM., 49-58, 1961.

THIS PAPER DISCUSSES THE FACTORS THAT MUST BE CONSIDERED WHEN WASTE DISPOSAL IN DEEP WELLS IS PROPOSED AND SUMMARIZES THE DISPOSAL WELL PROJECT AT THE IMPERIAL OIL LIMITED'S REFINERY AND CHEMICAL PLANT AT SARNIA, ONT. (CANADA). TO AVOID CONTAMINATION OF THE ST. CLAIR RIVER, FIVE INJECTION WELLS WERE DRILLED TO INJECT THE WASTES INTO THE DETROIT RIVER GROUP, A SEQUENCE OF POROUS DOLOMITES AND ANHYDRITES BETWEEN DEPTHS OF 500 AND 1,000 FEET BELOW THE REFINERY SITE. INJECTION PRESSURES ARE RESTRICTED TO SELF-IMPOSED LIMITS OF 400 PSIG. AT THIS PRESSURE, RATES OF INJECTION RANGED FROM 10 BARRELS PER HOUR TO 130 BARRELS PER HOUR. AFTER WELL STIMULATION TECHNIQUES WERE USED, THE TOTAL INJECTION CAPACITY OF FOUR OF THE WELLS WAS INCREASED FROM 200 BARRELS PER HOUR TO 250 BARRELS PER HOUR. THE TOTAL COST OF THE ENTIRE PROJECT INCLUDING SURFACE FACILITIES WAS ABOUT $190,000. IN ALL PROBABILITY, SEVERAL MORE WELLS WILL BE DRILLED TO HANDLE THE ANTICIPATED VOLUME OF WASTES.

00793. GROUND WASTE DISPOSAL PRACTICES AT THE SAVANNAH RIVER PLANT.

MARTER, W.L.
DISPOSAL OF RADIOACTIVE WASTES INTO THE GROUND INTERNATIONAL ATOMIC ENERGY AGENCY AND EUROPEAN NUCLEAR ENERGY AGENCY, VIENNA, 1967, SYMPOSIUM PROC., 95-106, 1967 (STI/PUB/156.

00794. HYDRAULIC FRACTURING AS A WASTE DISPOSAL METHOD.

MCCLAIN, W.C.
AEC OAK RIDGE NATIONAL LAB., TENN., 20 P, 1967.

A METHOD IS DESCRIBED FOR THE SUBTERRANEAN DISPOSAL OF RADIOACTIVE WASTE. THE METHOD WHICH IS BASED ON HYDRAULIC FRACTURING CONSISTS OF PUMPING A MIXTURE OF AQUEOUS WASTE AND CEMENTS INTO A NEARLY HORIZONTAL FRACTURE LOCATED IN A DEEP SHALE FORMATION. AFTER INJECTION OF THE MIX-

TURE, THE CEMENTS SERVE AS A CONFINING SEAL FOR THE RADIOACTIVE WASTE. THE MOST ECONOMIC CEMENT SOLUTION WAS FOUND TO CONSIST OF PORTLAND CEMENT (TYPE II), FLY ASH, ATTAPULGITE CLAY TO PREVENT PHASE SEPARATION, ILLITE (GRUNDITE) TO SERVE AS RETENTION OF RADIOCESIUM, AND A RETARDER (DELTA GLUCONOLACTONE). ANALYSIS OF THE STRESSES AND DEFORMATIONS INDUCED AROUND THE INJECTED MIXTURES INDICATES THAT ANY FAILURE OF THE ROCK BARRIER WILL CAUSE A VERTICAL FRACTURE RATHER THAN AN EXTENDED HORIZONTAL FRACTURE. A METHOD OF CALCULATING THE MAXIMUM CAPACITY OF A FRACTURE FACILITY IN TERMS OF ALLOWABLE STRESSES IS PRESENTED. DATA ON COST ANALYSIS AND EVALUATION PROCEDURES FOR POSSIBLE SITES ARE ALSO PRESENTED.

00795. HOW TO FORECAST ACCURATE DRILLING COSTS.

MECHAM, O.E.; LEGGE, M.S.
WORLD OIL, 151(5), 112-116, 1960.

DRILLING CONTRACTORS ARE FINDING IT IMPERATIVE TO DETERMINE, WITH THE GREATEST ACCURACY POSSIBLE, COST FACTORS ON WHICH DRILLING BIDS WILL BE BASED. EXPERIENCE HAS SHOWN THAT UNDER NORMAL DRILLING CONDITIONS, NET DRILLING DAYS AND DRILL BIT NEEDS CAN BE FORECAST CONSISTENTLY WITH AN ACCURACY OF 95 TO 97 PERCENT, USING THE PROFILE METHOD OF ESTIMATING DRILLING PENETRATION RATES AND DRILL BIT REQUIREMENTS. THIS METHOD MAKES USE OF DRILLING ANALYSIS CHARTS ON WHICH ARE PLOTTED PROFILES OF (1) OVERALL DRILLING PROGRESS, (2) NET DRILLING PROGRESS, AND (3) ROTATING PROGRESS, AS WELL AS OTHER DRILLING DATA ON PREVIOUSLY DRILLED WELLS. FROM THIS INFORMATION A REASONABLY ACCURATE ESTIMATE CAN BE MADE OF THE DRILLING TIME AND BITS THAT WILL BE NEEDED TO COMPLETE THE PROPOSED WELL. THE PROFILE METHOD OF FORECASTING DRILLING COSTS HAS BEEN TIME-TESTED IN MANY AREAS AND FOUND TO BE VERY ACCURATE WHEN PROPERLY APPLIED.

00796. UNDERGROUND DISPOSAL OF INDUSTRIAL WASTES.

MOFFETT, J.G. JR.
SHORT COURSE FOR SUPERINTENDENTS AND OPERATORS OF WATER AND SEWERAGE SYSTEMS, 23RD ANN., GEN. EXT. DIV AND COLLEGE OF ENGIN. OF LA. STATE U., BSTON ROUGE, 1960, PROC., LA. STATE U. ENG. EXPT. STA. BULL 64, 155-162, 1960.

SHELL CHEMICAL COMPANY'S FIRST DEVELOPMENT VENTURE WITH UNDERGROUND DISPOSAL OF INDUSTRIAL WASTE UTILIZING A MINIMUM CAPITAL INSTALLATION HAS BEEN A SUCCESSFUL ONE. A SECOND DISPOSAL WELL HAS BEEN DRILLED FOR CONTINUATION OF DEVELOPMENT STUDIES AND TO DISPOSE OF ALL THE WASTE WATER FROM NEW ACROLEIN AND GLYCERINE UNITS TO BE COMPLETED AT NORCO (LA.) IN 1960. FOR THOSE WHO ARE CONSIDERING UNDERGROUND DISPOSAL, IT MUST BE EMPHASIZED THAT SUCCESS IN UNDERGROUND DISPOSAL OF INDUSTRIAL WASTE WILL BE EXPENSIVE AND WILL DEPEND ON A SUITABLE INSTALLATION, FACILITIES, AND ABILITY TO PREPARE PROPERLY THE WASTE STREAM TO BE COMPATIBLE WITH UNDERGROUND FORMATIONS AND WATERS.

00797. SUBSURFACE DISPOSAL OF SALT WATER IN THE EAST TEXAS FIELD.

MORRIS, W.S.
PETROLEUM ENGINEER, 14(11), 41-49, 53, 1960.

IN DISCUSSING THE SUBSURFACE DISPOSAL OF SALT WATER IN THE EAST TEXAS FIELD BY INJECTING IT INTO THE WOODBINE SAND, THE AUTHOR DOES THE FOLLOWING: TRACES THE HISTORY OF THESE DISPOSAL PROJECTS, BOTH THOSE OWNED BY INDIVIDUAL COMPANIES AND BY THE EAST TEXAS SALT WATER DISPOSAL CO., WHICH IS OWNED BY 249 COMPANIES; MAPS THE ENCROACHMENT OF WATER IN THE FIELD; GRAPHS AND TABULATES THE SALT WATER AND OIL PRODUCTION SINCE 1931, THE RESERVOIR PRESSURE, THE NUMBER OF INJECTION SYSTEMS, THE AMOUNT OF SALT WATER INJECTED, AND THE COST OF INJECTION AS A FUNCTION OF THE INJECTION RATE; LISTS THE OWNERSHIP AND OPERATING DATA OF THE 56 INJECTION WELLS; AND DESCRIBES THE METHOD OF DRILLING INJECTION WELLS, THE TREATMENTS GIVEN THE WATER TO OXIDIZE THE IRON, KILL THE BACTERIA, AND REMOVE FOREIGN MATTER, THE SALT WATER GATHERING SYSTEMS OF CEMENT-LINED ASBESTOS OR WOOD FIBER COAL TAR-IMPREGNATED PIPE, AND THE SALT WATER PITS, USUALLY MADE OF GUNITE. ALTHOUGH THE COSTS OF INJECTION VARY GREATLY THROUGHOUT THE FIELD, THEY ARE ALWAYS REASONABLE. THE AUTHOR'S COMPANY CHARGES 1.8 CENTS PER BBL., A COST THAT IS OFFSET BY THE TEXAS RAILROAD COMMISSION'S ALLOWING THE PRODUCTION OF AN ADDITIONAL BARREL OF OIL FOR EACH 50 BBL. SALT WATER RETURNED TO THE FORMATION.

00798. RELATION BETWEEN SELECTED PHYSICAL PARAMETERS AND COST RESPONSES FOR THE DEEP WELL DISPOSAL OF AQUEOUS INDUSTRIAL WASTES.

MOSELEY, J.C. II; MALINA, J.F. JR.
AUSTIN, U. TEXAS CTR. FOR RCH. IN WATER RESOURCES REPT. CR WR 28, 276 P, 1968.

THE OBJECTIVES OF THIS INVESTIGATION WERE: (A) TO DEVELOP THE EQUATIONS AND THE SYSTEMS OF EQUATIONS GOVERNING THE PERFORMANCE OF AN INJECTION WELL, (B) TO COLLECT ECONOMIC DATA ON THE COMPONENTS OF SUCH A SYSTEM, (C) TO DEVELOP A COMPUTERIZED DESIGN AND COST MODEL GIVING THE COST RESPONSES TO THE INPUT VARIABLES, (D) TO TEST THIS MODEL ON MANY FEASIBLE INPUT DATA COMBINATIONS, AND (E) TO DEVELOP GENERALIZED RELATIONSHIPS BETWEEN PHYSICAL CONDITIONS AND THE COSTS OF INJECTION. PHYSICAL RELATIONSHIPS IN COMMON USAGE IN THE PETROLEUM INDUSTRY WERE MODIFIED WHERE NECESSARY AND USED TO DESCRIBE THE BEHAVIOR OF THE INJECTION SYSTEM. KNOWLEDGE AND INFORMATION FROM OTHER DISCIPLINES, INCLUDING GEOLOGY, CHEMICAL ENGINEERING, AND CIVIL ENGINEERING, WERE UTILIZED WHERE APPLICABLE. COST DATA WERE COLLECTED FROM A VARIETY OF SOURCES, ESPECIALLY THE PETROLEUM AND CHEMICAL ENGINERING FIELDS. THE RESULTING MODEL WAS TESTED ON DATA COLLECTED FROM PUBLISHED SOURCES AND OTHER SELECTED VALUES. THE RESULTING INFORMATION WAS ANALYZED AND RELATIONSHIPS BETWEEN INPUT VARIABLES AND COST RESPONSES WERE DEVELOPED. THE RESULTS OF THIS PRELIMINARY STUDY INDICATE THAT DEEP-WELL INJECTION OF AQUEOUS WASTES IS BOTH TECHNICALLY AND ECONOMICALLY FEASIBLE UNDER CERTAIN CONDITIONS. THE COST OF THIS OPERATION MAY RUN UPWARD FROM A MINIMUM OF 25 CENTS TO 40 CENTS PER THOUSAND GALLONS, INCLUDING MINIMAL PREINJECTION TREATMENT AND AMORTIZATION OF THE INITIAL CAPITAL INVESTMENT. CERTAIN ASPECTS OF THIS OPERA-

TION DIFFER SUFFICIENTLY FROM THOSE OF THE OIL INDUSTRY TO MERIT FURTHER INVESTIGATION. THESE INCLUDE (A) THE EVALUATION OF CERTAIN COMMON PETROLEUM PRACTICES IN THE LIGHT OF CONSTRAINTS PLACED ON INJECTION OPERATIONS, (B) THE DEVELOPMENT OF A METHOD TO BETTER PREDICT FLUID INCOMPATIBILITY, (C) THE EVALUATION OF VARIOUS FORMATIONS AND WASTES TO DETERMINE IF THEY ARE SUITABLE FOR THIS TYPE OF DISPOSAL, AND (D) A DETAILED STUDY OF POSSIBLE LONG-TERM EFFECTS.

00799. AN APPRAISAL OF GASEOUS WASTE DISPOSAL INTO THE LITHOSPHERE AT THE NATIONAL REACTOR TESTING STATION, IDAHO.

MUDRA, P.J.; SCHMALZ, B.L.
AEC, IDAHO OPERATIONS OFFICE, 141 P. (IDO-12024.

A SERIES OF GAS-INJECTION FIELD TESTS WERE PERFORMED AT THE NATIONAL REACTOR TESTING STATION, IDAHO, DURING THE SUMMER OF 1964, TO DETERMINE THE FEASIBILITY OF DISCHARGING RADIOACTIVE GASEOUS WASTE TO THE LITHOSPHERE. SPECIFIC OBJECTIVES INCLUDED THE DETERMINATION OF THE: (A) STORAGE CAPACITY OF THE LITHOSPHERE, (B) DIRECTION AND VELOCITY OF MIGRATION OF THE INJECTED GAS, (C) DILUTION AND DISPPERSION EFFECTS ON THE INITIAL CONCENTRATION OF THE INJECTED GAS, AND (D) PRESSURES REQUIRED FOR INJECTION. A COST ESTIMATE USING THIS CONCEPT UNDER HYPOTHETICAL CIRCUMSTANCES WAS ALSO DEVELOPED. HELIUM WAS USED AS A TRACER GAS TO IDENTIFY APPROXIMATELY 33 MILLION STANDARD CUBIC FEET OF AIR INJECTED INTO POROUS ZONES BOTH ABOVE AND BELOW THE REGIONAL WATER TABLE WITHIN THE SUBSURFACE BASALTS UNDERLYING THE STATION AND INTO THE UNCONSOLIDATED SANDY REGLOITH MATERIALS. THE MAXIMUM DEPTH OF INJECTION WAS 400 FEET BELOW LAND SURFACE. A MEAN PRESSURE OF 15 PSIG WAS REQUIRED TO MAINTAIN AN INJECTION RATE OF 1000 CUBIC FEET PER MINUTE INTO THE UNSATURATED BASALT ZONES. OBSERVATIONS INDICATED THAT NO FINITE GEOLOGICAL RESERVOIR EXISTED IN THE SUBSURFACE AND THAT THE REGOLITH MATERIALS OFFERED THE MOST RESTRICTIVE BARRIER TO VERTICAL MOVEMENT. ALTHOUGH INJECTED GAS COULD EVENTUALLY ARRIVE AT LAND SURFACE, THE AMOUNT OF DISPERSION AND DILUTION OBSERVED INDICATES THAT LITHOSPHERIC GAS DISPOSAL IS FEASIBLE AT THE NRTS FOR SINGLE INJECTION VOLUMES OF UP TO 6 MILLION STANDARD CUBIC FEET. THE COST FOR LITHOSPHERIC DISPOSAL SYSTEM IS ESTIMATED AT A MAXIMUM OF $250,000.

00800. DISPOSAL OF NUCLEAR POWER REACTOR WASTES BY INJECTION INTO DEEP WELLS.

PECSOCK, D.A.
AEC OAK RIDGE NATIONAL LAB., TENN., CF-54-10-64, 24 P, 1954.

EXPERIENCE IN THE DEEP WELL DISPOSAL OF VAPIOUS CHEMICAL WASTES HAS DEMONSTRATED CERT HERENT ADVANTAGES OF THIS MODE OF DISPOSAL, NAMELY, THE COMPARATIVE LOW COST OF INSTALLATION, MAINTENANCE, AND OPERATION AND THE ELIMINATION OF THE WASTE FROM SURFACE WATERS. TO ENSURE THE FEASIBILITY OF THIS DISPOSAL METHOD FOR A PARTICULAR WASTE, EXPERIENCE IN THE CHEMICAL INDUSTRY HAS INDICATED THAT THE GEOLOGICAL AREA UNDER QUESTION MUST BE PROPERLY SURVEYED AND FOUND SATISFACTORY AND THAT THE CHEMICAL COMPATIBILITY OF THE WASTE AND UNDERGROUND MEDIA MUST BE APTLY DEMONSTRATED. ONE OF THE INHERENT DISADVANTAGES OF THE METHOD IS THE LOSS OF CONTACT WITH THE WASTE MATERIAL, AND CONSEQUENTLY, THE POSSIBILITY OF CONTAMINATION OF SOME UNDERGROUND STRATA OF VALUE TO MANKIND. AS TO THE FEASIBILITY OF DISPOSING OF NUCLEAR POWER REACTOR WASTES INTO DEEP WELLS, GEOGRAPHICAL LOCATIONS MUST BE SOUGHT WHICH PROVIDE SUFFICIENT PHYSICAL CAPACITY FOR CONTAINMENT OF THE WASTE AND WHICH ENSURE THE PREVENTION OF HEALTH HAZARD RESULTING FROM MIGRATION OF RADIOACTIVE MATERIALS FROM THE DISPOSAL SITE. GEOLOGICAL AND GROUND WATER CONDITIONS APPEAR MOST SUITABLE FOR SUCH DISPOSAL AREAS IN THE CENTRAL STATES, BOUND BY THE APPALACHIAN MOUNTAINS ON THE EAST AND THE GREAT PLAINS REGION ON THE WEST.

00801. DISPOSAL OF LIQUID WASTES BY INJECTION UNDERGROUND--NEITHER MYTH NOT MILLENNIUM.

PIPER, A.M.
USGS, WASH., GEOL. SURVEY CIRCULAR 631, 1969, 15 P.

INJECTING LIQUID WASTES DEEP UNDERGROUND IS AN ATTRACTIVE BUT NOT NECESSARILY PRACTICAL MEANS FOR DISPOSING OF THEM. FOR DECADES, LARGE VOLUMES OF UNWANTED OIL-FIELD BRINE HAVE BEEN INJECTED. CURRENTLY THE INJECTION RATE IS ABOUT 10,000 ACRE-FEET YEARLY, AND THE RATE IS INCREASING RAPIDLY WITH TIME. EFFECTS OF DEEP INJECTION ARE COMPLEX AND NOT ALL ARE UNDERSTOOD CLEARLY, BUT IN A RESPONSIBLE SOCIETY, INJECTION CANNOT BE ALLOWED TO PUT WASTES OUT OF MIND. INJECTION IS NO MORE THAN STORAGE IN UNDERGROUND SPACE OF WHICH LITTLE IS ATTAINABLE IN SOME AREAS AND WHICH IS EXHAUSTIBLE IN MOST AREAS. LIQUID WASTES RANGE WIDELY IN CHARACTER AND CONCENTRATION-- SOME ARE INCOMPATIBLE ONE WITH ANOTHER OR WITH MATERIALS OF THE PROSPECTIVE INJECTION ZONE; SOME WHICH ARE REACTIVE OR CHEMICALLY UNSTABLE WOULD REQUIRE PRETREATMENT OR COULD NOT BE INJECTED. STANDARDS BY WHICH TO CATEGORIZE THE WASTES ARE URGENTLY DESIRABLE. FEW, IF ANY, STATE AGENCIES CURRENTLY HAVE THE STAFF SKILLS, CENTRALIZED AUTHORITY, AND FINANCIAL RESOURCES TO REGULATE DEEP INJECTION. THEREFORE, SOME NEW INSTITUTIONAL ARRANGEMENT WITH HIERARCHICAL STRUCTURE APPEARS TO BE ESSENTIAL TO ASSURE A UNIFIED POLICY NATIONWIDE.

00802. DISPOSAL OF OIL FIELD BRINES.

REED, P.
OIL AND GAS J., 37(46), 174-175, 1939.

A CONTINUOUS SYSTEM FOR THE DISPOSAL OF OIL FIELD BRINES BY PRESSURE INJECTION IN CONNECTION WITH A CLOSED SYSTEM HAS BEEN DESIGNED BY THE RYAN CONSOLIDATED PETROLEUM CORP. AND INSTALLED IN THE BEMIS POOL IN KANSAS TO HANDLE A DAILY SALT WATER PRODUCTION OF 1,877 BBL. WHICH IS ENCROACHING AT THE RATE OF 8% MONTHLY. IN OPERATION, THE BRINE FLOWS BY GRAVITY FROM TANK BATTERIES TO A VACUUM-RESISTANT TANK EQUIPPED WITH A VACUUM GAUGE, BAFFLED INLETS AND OUTLETS, GAUGE GLASSES, DRAINS, AND A SEPARATOR SWITCH TO CONTROL THE PUMP. FROM THE TANK THE BRINE IS INJECTED INTO THE CHEYENNE SANDSTONE AT 235 LBS. PRESSURE AT THE PUMP AT A RATE OF 186 BBL. /HOUR. OPERATIONS ARE JUDGED BY A RECORDING PRESSURE GAUGE WHICH IS CHANGED DAILY AND FROM CURVES WHICH MAY BE COMPUTED SHOWING THE QUANTITY OF SALT WATER INJECTED INTO THE DISPOSAL WELL. ANALYSES OF BRINE

SAMPLES TAKEN AT AN OIL WELL BLEEDER AND AT THE HEAD OF THE SALT WATER DISPOSAL WELL ARE TABULATED. THE COSTS OF THE PUMPING STATION, LEAD LINES, AND OF DRILLING AND EQUIPPING THE DISPOSAL WELL ARE GIVEN.

00803. DISPOSAL OF WASTE RADIOACTIVE GASES IN POROUS UNDERGROUND MEDIA.

REIST, P.C.
NUCLEAR APPLICATIONS, 3(8), 474-480, 1967.

UNDERGROUND STORAGE AS A DISPOSAL METHOD FOR LONG-LIVED RADIOACTIVE GASES IS AN ATTRACTIVE POSSIBILITY. IT IS ESTIMATED THAT RADIOACTIVE GASES COULD BE DISPOSED OF UNDERGROUND FOR ABOUT $2/1000 CU FT (ATM) OF WASTE GAS. POSSIBLE PROBLEMS WHICH MIGHT ARISE WITH THIS TYPE OF DISPOSAL ARE DISCUSSED.

00804. DISPOSAL OF SALT WATER IN THE EAST TEXAS FIELD.

RHEA, A.S.; MILLER, E.B. JR.
PETROLEUM TECHNOLOGY, 3(1), TECH. PAPER 1151, P 1-10.

BECAUSE OF THE GRADUAL INCREASE IN THE AMOUNT OF SALT WATER PRODUCED IN THE EAST TEXAS FIELD, THE PRESENT PRODUCTION AMOUNTING TO 200,000 BBL. PER DAY, EXPERIMENTS WERE CONDUCTED TO ATTEMPT SUBSURFACE INJECTION OF SALT WATER INTO THE WOODBINE SANDS, THEREBY DISPOSING OF THE WATER AND SIMULTANEOUSLY INCREASING THE OIL RESERVOIR PRESSURE, ENABLING A GREATER RECOVERY OF OIL. IT WAS FOUND THAT THE CLOSED SYSTEM TYPE OF DISPOSAL WAS IMPRACTICABLE BECAUSE OF PLUGGING, APPARENTLY DUE TO PRECIPITATION OF THE IRON IN THE WATER. THE OPEN SYSTEM WORKED SATISFACTORILY, BUT IT WAS NECESSARY TO KEEP THE AERATED WATER, WHICH IS VERY CORROSIVE, FROM TOUCHING ANY METAL SURFACES BY LINING THE PIPES WITH CEMENT OR CEMENT-ASBESTOS. COPPER SULFATE IS ADDED TO PREVENT GROWTH OF ALGAE, AND CALCIUM HYPOCHLORITE AND CHLORINE ARE ADDED TO STOP BACTERIAL ACTION. USING THE OPEN SYSTEM TYPE, INJECTION WAS CARRIED ON FOR ABOUT 10 MONTHS, WITH A DECREASE IN EFFECTIVE PERMEABILITY BEING NOTICED AFTER THE 8TH MONTH. AT THE 10TH MONTH, THE WELL WAS STILL TAKING ABOUT 2200 BBL. WATER/DAY WITH A SURFACE PRESSURE OF 40 LB. A CHART OF PERFORMANCE DURING INJECTION IS PRESENTED. IT WAS FOUND THAT (1) THE OPEN SYSTEM IS THE BEST METHOD OF DISPOSAL, BUT THAT PLUGGING CAUSES A DECLINE IN INJECTION RATE, DUE TO THE IRON AND SUSPENDED MATTER, AND OTHER UNKNOWN CAUSES; (2) THE DISPOSAL WELL MUST BE CAREFULLY CLEANED TO REMOVE ALL FOREIGN MATTER FROM THE SAND SURFACES; AND (3) COMPLETING THE WELL BY SETTING A NONCORROSIVE PERFORATED LINER AND GRAVEL PACKING OR BY SETTING A NONCORROSIVE BLANK LINER AND PERFORATING OPPOSITE THE SAND ZONES FOR INJECTION MAY BE NECESSARY. THE COST OF A SALT WATER DISPOSAL PLANT IS BETWEEN $20,000 AND $30,000. COSTS PER BARREL HAVE NOT BEEN COMPUTED SINCE FIGURES ON THE LIFE OF THE PLANT ARE NOT YET AVAILABLE. A PLANT FOR THE CHEMICAL TREATMENT OF WATER, TO REMOVE INTERFERING SUBSTANCES, IS UNDER CONSIDERATION.

00805. DEEP WELL DISPOSAL OF INDUSTRIAL WASTES.

SELM, R.P.; HULSE, B.T
INDUSTRIAL WASTE CONF., 14TH, LAFAYETTE, INC., 1959. PROC.: PURDUE U. ENG. EXT. SER. 104, 44(5), ENG. BULL, 566-587, 1970.

DEEP WELLS CAN BE VERY EXPENSIVE DISPOSAL FACILITIES. THE COSTS DEPEND UPON THE NATURE OF PRETREATMENT REQUIRED, DEPTH OF THE HOLE, CORROSIVITY OF THE WASTE, STATE REGULATIONS, NATURE OF THE FORMATION, AND MANY OTHER FACTORS. DEEP WELL DISPOSAL WILL NOT ORDINARILY COMPETE WITH SURFACE DISPOSAL PROCESSES, CHEMICAL OR BIOLOGICAL, UNLESS HIGH TOTAL DISSOLVED SALTS CONCENTRATIONS ARE PRESENT. A VERY ROUGH RULE WOULD BE THAT A SINGLE WELL INSTALLED SHOULD BE ABLE TO DISPOSE OF 500 MILLION GALLONS OF WASTE TO BE ON AN EQUAL FIRST COST BASIS WITH A BIOLOGICAL OR CHEMICAL TREATMENT FACILITY. IN SOME CASES THE WASTE MAY REQUIRE MORE EXTENSIVE CHEMICAL TREATMENT FOR INJECTION THAN MAY BE REQUIRED FOR SURFACE DISPOSAL. COMPATIBILITY TREATMENT TO PREVENT CLASS I PRECIPITATES IS SELDOM REQUIRED OF WASTES FOR SURFACE DISPOSAL, AND SUCH TREATMENT CAN CAUSE INJECTION TO BE CONSIDERABLY MORE COSTLY FOR SOME WASTE DISPOSAL PROJECTS. WASTE DISPOSAL WELLS NORMALLY COST BETWEEN $50,000 AND $250,000 FOR COMPLETION OF EACH WELLHEAD. THE AVERAGE FLOW CAPACITY TO BE MAINTAINED FOR A 4-INCH WELL STRING RECEIVING CONDITIONED WATER SHOULD BE ESTIMATED AT ABOUT 200 GPM (286 BBL/HR), ALTHOUGH THESE FIGURES DEPEND ON SO MANY FACTORS THAT THEY ARE LITTLE MORE THAN A GUIDE. CERTAINLY THE OLD RULE THAT EVERY WASTE SHOULD BE TREATED AT THE PROCESS FIRST SHOULD BE INVESTIGATED BEFORE DEEP WELL DISPOSAL. THE PRESENCE OF INTOLERABLE AMOUNTS OF DISSOLVED SALTS IS ALMOST MANDATORY BEFORE DEEP WELL DISPOSAL IS DEFINITELY MORE ECONOMIC THAN SURFACE DISPOSAL TECHNIQUES.

00806. EAST TEXAS SALT WATER DISPOSAL PROJECT MAY SET PATTERN FOR FUTURE.

SIMONS, H.F.
OIL AND GAS J., 41(39), 38-41.

THE EAST TEXAS SALT-WATER DISPOSAL CO., CAPITALIZED FOR $2,000,000, HAS BEEN FORMED BY THE 249 COMPANIES AND OPERATORS IN THE EAST TEXAS FIELD FOR OPERATION OF THE COOPERATIVE PROJECT OF RETURNING THE SALT WATER PRODUCED FROM THE WOODBINE FORMATION BACK TO THE SAME FORMATION. THE INJECTION PAYS FOR ITSELF FROM THE BONUS PERMITTED BY THE TEXAS RAILROAD COMMISSION OF 1 BBL. OF OIL FOR EACH 50 BBL. OF SALT WATER INJECTED. AT THE SAME TIME IT MAINTAINS THE NATURAL WATER DRIVE.

00807. WASTE WATER DISPOSAL BY SUBSURFACE INJECTION CALIFORNIA OIL FIELDS.

SMITH, E.R.; OLSON, E.A.
DALLAS, TEX.: AM. PETRO. INST., DIV. PROD. PAPER NO. 801-35F, 9 P, 1959.

PRIMARILY THIS PAPER PRESENTS FACTUAL DATA PERTAINING TO DISPOSAL WELL AND INJECTION SANDS, SURFACE FACILITIES, CHEMICAL TREATMENT, INJECTION HISTORY, REMEDIAL OPERATIONS, COST DATA (BOTH ORIGINAL INVESTMENT AND OPERATING), AND WATER ANALYSIS OF 44 WELLS AND 42 SYSTEMS IN 5 AREAS OF THE STATE. THE MORE OBVIOUS CONCLUSIONS OF THESE DATA ARE BRIEFLY DISCUSSED AND TABULATED.

TOGETHER WITH AN ESTIMATED MINIMUM EXPENDITURE FOR INVESTMENT AND DISPOSAL COSTS TO DATE TO THE OPERATORS OF THESE SYSTEMS.

00808. DISPOSAL LINE COST COMPARISON.

STEARNS, G.M.
OIL AND GAS J., 42(11), 47, 1943.

THE CONCEPT OF DISPOSING OF LIQUID INDUSTRIAL WASTES BY DEEP-WELL INJECTION IS NOT A NEW ONE. BRINES ASSOCIATED WITH CRUDE OIL LONG HAVE BEEN DISPOSED OF IN THIS MANNER, WITH THE ADDITIONAL BENEFIT OF AIDING SECONDARY OIL RECOVERY. MORE RECENTLY, WITH THE EXPANSION OF NUCLEAR ENERGY, THE LETHAL, HIGHLY RADIOACTIVE WASTES WHICH ARE BY-PRODUCTS OF THE FISSION PROCESS HAVE CREATED SEVERE DISPOSAL PROBLEMS. DURING THE PAST 10 YR, A VARIETY OF INDUSTRIES HAS RESORTED TO SUBSURFACE DISPOSAL. THE LIST REVEALS WIDE VARIATIONS IN INJECTION RATE, PUMPING PRESSURE, COST, AND WASTE DISPOSITION. ENACTMENT OF MORE RESTRICTIVE CLEAN WATER LEGISLATION IN PENNSYLVANIA RECENTLY HAD A GREAT IMPACT ON THE COAL INDUSTRY. AMONG ITS PROVISIONS WAS THE RECLASSIFICATION OF MOST MINE WATER AS INDUSTRIAL WASTE WHOSE DISPOSAL IS PROHIBITED IN ANY STREAM OF THE COMMONWEALTH. THIS HAD THE EFFECT OF ACCELERATING RESEARCH IN A VARIETY OF AREAS ALTHOUGH TREATMENT METHODS STILL RETAIN PRIMARY INTEREST. WHEN A FEASIBILITY STUDY OF DEEP-WELL DISPOSAL WAS PROPOSED TO THE PENNSYLVANIA DEPARTMENT OF MINES AND MINERAL INDUSTRIES, THE COAL RESEARCH BOARD APPROVED IT. THE EFFORTS ON THIS PROJECT ARE SUMMARIZED.

00809. COST ESTIMATES FOR REINJECTING SALT WATER TO THE EAST TEXAS WOODBINE SAND.

STORMONT, D.H.
OIL WEEKLY, 104(2), 24, 26, 1941.

COST ESTIMATES FOR REINJECTING SALT WATER INTO THE EAST TEXAS WOODBINE SAND TOTAL $3,307,740, $3,067,169 AND $2,770,873 FOR THREE PLANS WHICH INVOLVE, RESPECTIVELY, (1) USING PRESENT INJECTION FACILITIES, VALUED AT $1,250,000 AND DRILLING 28 NEW INJECTION WELLS MOSTLY OUTSIDE THE FIELD; (2) USING PRESENT FACILITIES AND DRILLING 37 NEW INJECTION WELLS, MOSTLY INSIDE THE FIELD; AND (3) LEAVING PRESENT INJECTION FACILITIES AT THEIR CURRENT RATE OF INJECTION AND PROVIDING FACILITIES FOR THE REMAINING INJECTION REQUIREMENTS, INVOLVING THE DRILLING OF 39 NEW WELLS, MOSTLY OUTSIDE THE FIELD. THE 46 INJECTION SYSTEMS NOW IN OPERATION HANDLE ABOUT 72,500 BBL. OF THE FIELD'S 456,000 BBL. DAILY SALT WATER PRODUCTION.

00810. RADIOACTIVE WASTE DISPOSAL.

STRUXNESS, E.G.; MORTON, R.J.; PARKER, F.L.
HEATH PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1962. AEC OAK RIDGE NATIONAL LAB., TENN., P1-46, 1962 (ORNL-3347).

IT NOW SEEMS LIKELY THAT INITIAL APPLICATION OF DEEP-WELL LIQUID INJECTION TECHNIQUES WILL BE IN THE DISPOSAL OF HIGH-VOLUME, LOW-LEVEL PROCESS WASTE WATER THAT WILL REQUIRE CONTAINMENT FOR ABOUT 200 YR DUE TO THE PRESENCE OF SR90. STUDIES ON THE EXCHANGE PROPERTIES OF SR, CA, CS, AND RU WITH SOILS LED TO THE CONCLUSION THAT THE RESTRICTED MOVEMENT OF RADIONUCLIDES COMPARED TO WATER WOULD MAKE IT POSSIBLE TO USE A DEEP AQUIFER AS A LARGE ION EXCHANGE BED, RATHER THAN JUST AS A STORAGE BASIN. A STUDY WAS MADE OF THE FEASIBILITY OF DISPOSING OF LIQUID RADIOACTIVE WASTE BY MIXING WITH CEMENT, OR SOME OTHER HARDENING AGENT, AND THEN INJECTING THE SLURRY DEEP INTO BEDDED ROCK THROUGH A SPECIALLY CONSTRUCTED WELL. THE DEVELOPMENT AND TESTING OF SUITABLE MIXES ARE DISCUSSED AND RESULTS ARE REPORTED FROM A THREE-YEAR FIELD TEST. THE FEASIBILITY OF DISPOSAL OF SOLIDIFIED HIGH-LEVEL LIQUID WASTES IN SALT FORMATIONS WAS ALSO INVESTIGATED. CANNED FUEL ASSEMBLIES WERE USED TO SIMULATE THE SOLIDIFIED WASTES IN HEAT GENERATION AND RADIOACTIVITY. LABORATORY STUDIES WERE MADE ON THE EFFECTS OF TEMPERATURES GREATER THAN 80 C ON THE PHYSICAL PROPERTIES OF SALT. STUDIES WERE CONTINUED ON THE FATE OF RADIOISOTOPES RELEASED TO THE CLINCH RIVER, THE DILUTING CAPACITY OF THE RIVER SYSTEM, AND THE LONG-TERM EFFECTS OF RADIOACTIVE CONTAMINATION ON THE FLUVIAL ENVIRONMENT. A MAP OF THE CLINCH RIVER BASIN, SHOWING LOCATION OF SAMPLING STATIONS, IS INCLUDED. DATA ARE INCLUDED FROM AN INTENSIVE STUDY OF SOURCES OF CONAMINATION AND MOVEMENT OF RADIONUCLIDES IN THE WHITE OAK CREEK DRAINAGE AREA. STUDIES WERE CONTINUED ON ION EXCHANGE REACTIONS OF FISSION PRODUCTS WITH VARIOUS MINERALS, WITH EMPHASIS ON THE REMOVAL OF CS 137 AND SR 90 FROM WASTE SOLUTIONS. A STUDY WAS UNDERTAKEN TO EVALUATE THE ECONOMICS AND HAZARDS ASSOCIATED WITH ALTERNATIVE METHODS FOR ULTIMATE DISPOSAL OF HIGHLY RADIOACTIVE LIQUID AND SOLID WASTES. PRELIMINARY DATA ARE PRESENTED.

00811. THE DEEP WELL METHOD OF INDUSTRIAL WASTE DISPOSAL.

TALBOT, J.S.; BEARDON, P.
CHEM. ENG. PROG., 60(1), 19-52, 1967.

THE DEEP WELL METHOD IS A PROVEN TECHNIQUE, AND HAS BEEN USED FOR MANY YEARS BY OIL AND GAS PRODUCERS IN DISPOSING OF OIL FIELD BRINES AND BY VARIOUS PROCESS INDUSTRIES. IT IS CAPABLE OF HANDLING A GREAT VARIETY OF WASTES, AND IS A SAFE METHOD OF WASTE CONTROL. IT IS NOT A HAZARD TO POTABLE GROUNDWATERS OR TO COMMERCIAL MINERAL DEPOSITS. A PROPERLY CONSTRUCTED DISPOSAL WELL SHOULD EXCEED THE LIFE OF THE PLANT ITSELF, WITH 40 YR BEING A REASONABLE WELL LIFE. SEVERAL FACTORS MUST BE CONSIDERED IN DESIGNING A DISPOSAL SYSTEM: (1) LAWS OF STATES WHERE DISPOSAL IS CONTEMPLATED; (2) OVERALL LEGAL ASPECTS; (3) SUBSURFACE GEOLOGY; (4) GROUNDWATER HYDROLOGY; (5) ESTIMATED INJECTION PRESSURES AND VOLUMES; (6) CHEMICAL AND PHYSICAL PROBLEMS OF INJECTION; (7) PRELIMINARY DISPOSAL WELL DESIGN AND ESTIMATED COSTS; (8) PRELIMINARY SURFACE EQUIPMENT DESIGN AND ESTIMATED COSTS; AND (9) ESTIMATED COSTS OF OPERATION.

00812. SOME BASIC FACTORS IN THE CONSIDERATION AND INSTALLATION OF DEEP WELL DISPOSAL SYSTEMS.

TALBOT, J.S.
IND. WATER AND WASTE CONF., 7TH, TEXAS WATER POLLUTION CONTROL ASSN., AUSTIN, TEXAS, JUNE 1-2, 1967; PROC., AUSTIN, TEXAS U., P III-7-III-24, 1968.

THE BASIC DISPOSAL FACTORS OF DEEP INJECTION WELLS AND THE HAZARDS OF WELL DISPOSAL ARE DISCUSSED

WITH PARTICULAR ATTENTION TO PREVENTION OF DAMAGE TO POTABLE GROUNDWATER, COMMERCIAL MINERAL DEPOSITS, AND MINING ACTIVITIES. ECONOMIC, PUBLIC RELATIONS, AND LEGAL FACTORS ARE ALSO MAJOR CONSIDERATIONS FOR ANY WASTE DISPOSAL TECHNIQUES. MOST STATE AND FEDERAL LAWS EITHER ENCOURAGE OR DO NOT DISCOURAGE DEEP WELL DISPOSAL, BUT THE LEGAL ASPECTS OF TRESPASS ON UNDERGROUND PROPERTY AND DAMAGES TO PROPERTY BY DISPOSAL NEED LEGAL CLARIFICATION. WELL DESIGN AND SURFACE EQUIPMENT FOR DEEP WELL DISPOSAL ARE DESCRIBED. A METHOD FOR CALCULATING THE RADIUS OF INJECTION AND FORMATION CAPACITY FOR INJECTION IS GIVEN. GEOLOGICAL HAZARDS WHICH MIGHT CAUSE CONTAMINATION OF POTABLE WATER ARE BRIEFLY DESCRIBED.

00813. TYPICAL OIL FIELD BRINE-CONDITIONING SYSTEMS, PREPARING BRINE FOR SUBSURFACE INJECTION.

TAYLOR, S.S.; WILHELM, C.J.; HOLLIMAN, W.C.
U.S. BUR. MINES, REPT. INV. 3434, 71 P, 1939.

DETAILED DESCRIPTIONS ARE GIVEN OF THE CONSTRUCTION AND OPERATION OF SOME TYPICAL BRINE-CONDITIONING AND DISPOSAL SYSTEMS FOR PREPARING BRINE FOR SUBSURFACE INJECTION. DATA ARE GIVEN ON THE CHEMICAL AND CORROSIVE CHARACTERISTAICS OF BRINES, BEFORE, DURING AND AFTER CONDITIONING IN VARIOUS TYPES OF SYSTEMS FOR SUBSURFACE INJECTION. SEVERAL MODIFICATIONS OF STANDARD METHODS OF WATER ANALYSIS ARE DESCRIBED. CLOSED, OPEN AND SEMICLOSED TYPES OF SYSTEMS THAT ARE USED TO CONDITION THE SOUR BRINE AS WELL AS THE STABLE BRINES CONTAINING IRON ARE DISCUSSED. BRINES FROM FOUR TYPICAL FORMATIONS WERE STUDIED. COST DATA ARE INCLUDED FOR SEVERAL OF THE SYSTEMS.

00814. SUBSURFACE DISPOSAL OF OIL FIELD BRINES.

TEIS, K.R.
OIL WEEKLY, 100(5), 16-22, 24, 1941.

A COMPREHENSIVE OUTLINE OF THE PROCEDURE AND TECHNICAL DETAILS OF THE SUBSURFACE DISPOSAL OF OIL FIELD BRINES BY UTILIZING THE ABANDONED OR UNPROFITABLE OIL WELLS AS INPUT WELLS INCLUDES A TABULATED SUMMARY OF INPUT WELL DATA OF 73 KANSAS AND OKLAHOMA WELLS, INCLUDING A GROUP OF 18 WELLS AVERAGING MORE THAN 3700 BBL. /DAY/WELL DAILY INPUT. TREATMENT OF THE BRINE IN CLOSED- OR OPEN-TYPE TREATING SYSTEMS BY AERATION, CHEMICAL TREATMENT, SEDIMENTATION OR FILTERING IS SAID TO BE USUALLY REQUIRED WHEN LARGE QUANTITIES OF BRINE HAVE TO BE RETURNED TO DEEP WELLS HAVING TIGHT OR SIEVE FORMATIONS. THE USE OF CORROSION-RESISTANT CONDUITS SUCH AS PITCH-IMPREGNATED WOOD FIBER CONDUIT, SALT-GLAZED VITRIFIED CLAY SEWER PIPE, CONCRETE PIPE, CEMENT-ASBESTOS PIPE, OR CEMENT-LINE STEEL PIPE IS RECOMMENDED. OPERATING EXPENSES OF THE FITTS POOL DISPOSAL PLANT IN 1938 AND 1939 ARE TABULATED AND THE POOL AGREEMENT UNDER WHICH THIS PROJECT IS OPERATED IS OUTLINED IN DETAIL. A COOPERATIVE APPROACH TO THE PROBLEMS OF BRINE DISPOSAL, ON THE PART OF GOVERNMENT REGULATORY AND ENFORCEMENT OFFICERS, IS SUGGESTED.

00815. SALT WATER DISPOSAL.

TROEMPER, A.P.
INDEPENDENT MONTHLY, 12(9), 17-19; 12(10), 19-24, 1942.

PART I OF A THOROUGH REVIEW OF THE ENTIRE SUBJECT OF SALT WATER DISPOSAL FROM OIL FIELDS AND STREAM POLLUTION, WRITTEN IN TERMS OF ILLINOIS PRACTICE, DEALS WITH THE INJURIOUS EFFECTS OF OIL-FIELD BRINES, DISPOSAL FORMATIONS, AND THE ILLINOIS PROBLEM OF BRINE DISPOSAL. PART II SUMMARIZES DISPOSAL EQUIPMENT, TYPES OF BRINE TREATMENT, THE ECONOMICS OF SUBSURFACE DISPOSAL, AND POSSIBILITIES OF FURTHER EXPERIMENTATION.

00816. CELANESE DEEP WELL DISPOSAL PRACTICES.

VEIR, B.B.
IND. WATER AND WASTE CONF., 7TH, TEXAS WATER POLL. CONTROL ASSN., AUSTIN., TEXAS, JUNE 1-2, 1967; PROC. AUSTIN, TEXAS U, P I/W21-I/W24, III/25-III/36: 116(5), 1969.

THIS PAPER DEALS PRIMARILY WITH THE DEEP WELL DISPOSAL EXPERIENCE OF THE CELANESE CHEMICAL CO. IN BAY CITY, TEX. AN ECONOMIC COMPARISON BETWEEN A BIOLOGICAL-TREATMENT SYSTEM AND A DEEP-WELL SYSTEM SHOWED THAT THE PROPOSED DEEP-WELL SYSTEM WOULD COST TWICE AS MUCH IN CAPITAL OUTLAY, BUT THE ANNUAL OPERATING COST WOULD BE HALF AS MUCH. AFTER A STATE PERMIT FOR THE DEEP-WELL SYSTEM WAS GRANTED, A WELL WAS DRILLED TO INJECT WASTES INTO A BRINE-SATURATED MIOCENE SAND BETWEEN THE DEPTHS OF 3,350 AND 3,550 FEET BELOW THE PLANT SITE. SAMPLES OF NATIVE BRINE AND CORES WERE OBTAINED TO CHECK THE COMPATIBILITY OF THE WASTES WITH THE INJECTION FORMATION. A HEAVY WALL, BAKED-ON, EPOXY FIBERGLASS TUBING WAS USED IN THE WELL TO REDUCE CORROSION ATTACK OF THE WASTE TO A MINIMUM. PREINJECTION TREATMENT OF WASTE IS DESCRIBED. THE SUCCESS OF THE INITIAL WELL SYSTEM HAS PROMPTED THE CONSTRUCTION OF A SECOND SYSTEM AND PLANS ARE IN PROGRESS FOR A THIRD TO HANDLE WASTES FROM OTHER PLANT PROCESS AREAS.

00817. DEEP WELL WASTE INJECTION-REACTION WITH AQUIFER WATER.

WARNER, D.L.
ASCE J SANITARY ENGINEERING, 92(SA4), 45-69, AUG. 2966.

DEEP-WELL INJECTION IS A PROMISING METHOD FOR PERMANENTLY STORING SOME LIQUID WASTES. THE INFLUENCE OF REACTIONS BETWEEN INJECTED AND INTERSTITIAL WATERS ON AQUIFER PERMEABILITY IS A PROBLEM OF SIGNIFICANT INTEREST. A THEORETICAL AND LABORATORY STUDY HAS SHOWN THAT, UNDER SPECIFIED CONDITIONS, THE AMOUNT OF REACTION BETWEEN INJECTED AND INTERSTITIAL SOLUTIONS CAN BE ANTICIPATED IF THE DISPERSIVE CHARACTER OF THE POROUS MEDIUM IS KNOWN. LABORATORY EVIDENCE ALSO SHOWED THAT PERMEABILITY LOSS RESULTING FROM THE FORMATION OF SOME PRECIPITATES MAY NOT BE AS GREAT AS HAS BEEN SUGGESTED. OTHERS HAVE PROPOSED THAT, WHERE REACTION BETWEEN INJECTED WASTE AND INTERSTITIAL WATER IS UNDESIRABLE, A ZONE OF NONREACTIVE WATER CAN BE INJECTED BETWEEN THE WASTE AND THE AQUIFER WATER. THIS BUFFER-ZONE CONCEPT WAS SUBSTANTIATED IN THE LABORATORY AND EQUATIONS ARE PROPOSED FOR THE DESIGN OF SUCH ZONES IN FIELD SITUATIONS.

00818. SUBSURFACE INJECTION OF LIQUID WASTES.

WARNER, D.L.
WESTERN RES. PAPERS, V, BOULDER, COLO., U. COLO. PRESS, P 107-125, 1966.

SEVERAL PROCESSES FOR PERMANENT DISPOSAL OF UNUSABLE INORGANIC WASTE SOLUTIONS ARE SPREADING ON THE SURFACE OF THE EARTH, PIPELINE CONVEYANCE TO THE OCEAN, DEEP-WELL INJECTION, AND PLACEMENT IN UNDERGROUND CAVITIES. CONCENTRATED ORGANIC WASTES THAT CANNOT BE BIOLOGICALLY TREATED CAN BE WET-OXIDIZED OR INCINERATED, BUT SOME RESIDUE USUALLY REMAINS TO BE DISPOSED OF. THESE METHODS ARE LISTED IN A TABLE IN THEIR APPROXIMATE ORDER OF COST, PIPELINE CONVEYANCE TO THE OCEAN OR SURFACE SPREADING BEING THE MOST ECONOMICAL UNDER FAVORABLE CIRCUMSTANCES, AND INCINERATION BEING THE MOST EXPENSIVE. THE ESTIMATED COST OF DISPOSAL PER 1,000 GAL OF LIQUID WASTE IS $0.50 FOR A TYPICAL DEEP-WELL INJECTION SYSTEM, AS COMPARED WITH $0.01 FOR SURFACE SPREADING AND $10 FOR INCINERATION. NOT A NEW METHOD OF WASTE DISPOSAL, DEEP-WELL INJECTION HAS LONG BEEN IMPORTANT IN THE DISPOSAL OF OIL-FIELD BRINES BROUGHT TO THE SURFACE DURING THE PRODUCTION OF OIL AND GAS. HOWEVER, INTEREST IN USING INJECTION WELLS FOR DISPOSAL OF OTHER LIQUID WASTES, PARTICULARLY INDUSTRIAL WASTES, HAS INCRESASED IN RECENT YEARS AND IS EXPECTED TO INCREASE GREATLY IN THE FUTURE. IN ADDITION TO MORE CONVENTIONAL INDUSTRIAL WASTES, DEEP WELLS HAVE ALSO BEEN CONSIDERED FOR THE DISPOSAL OF RADIOACTIVE WASTES, WASTES FROM SALINE WATER CONVERSION PLANTS, AND WASTES FROM ADVANCED WASTE TREATMENT PLANTS.

00819. FEASIBILITY OF RADIOACTIVE WASTE DISPOSAL IN SHALLOW SEDIMENTARY FORMATIONS.

WATKINS, J.W.; ARMSTRONG, F.E.; HEEMSTRD, R.J.
NUCLEAR SCIENCE ENG., 7(2), 133-143, 1970.

ONE OF THE PRESSING PROBLEMS OF THE POTENTIAL NUCLEAR-POWER INDUSTRY IS THE NECESSITY FOR DISPOSING OF RADIOACTIVE WASTES INCIDENT TO OPERATING REACTORS AND RECOVERING FISSIONABLE MATERIAL FROM EXPENDED FUEL ELEMENTS. THE BUREAU OF MINES HAS MADE A DETAILED ANALYSIS OF THE FEASIBILITY OF SOLVING THIS PROBLEM, IN AREAS WHERE THE GEOLOGY PERMITS, BY INJECTING LIQUID WASTES INTO SHALLOW, PERMEABLE, SEDIMENTARY ROCK FORMATIONS. LABORATORY AND FIELD RESEARCH PROBLEMS PERTINENT TO THE DISPOSAL OF RADIOACTIVE WASTES BY INJECTION ARE OUTLINED. LABORATORY PROBLEMS INCLUDE ION EXCHANGE AND ADSORPTION OF FISSION PRODUCTS, CHEMICAL AND PHYSICAL REACTIONS BETWEEN INJECTED WASTES AND RESERVOIR SOLIDS AND FLUIDS, CORROSIVITY OF WASTES AND CORROSION RESISTANCE OF SPECIAL METALLIC ALLOYS, INJECTIVITY OF SOLUTIONS OF WASTE FISSION PRODUCTS, POTENTIAL HEAT GRADIENTS, AND TECHNIQUES FOR DETERMINING MIGRATION OF INJECTED WASTES. FIELD RESEARCH PROBLEMS INCLUDE HANDLING TECHNIQUES, INJECTIVITY, AND HORIZONTAL AND VERTICAL MIGRATION OF INJECTED RADIOACTIVE WASTES. A HYPOTHETICAL EXAMPLE IS GIVEN OF A PILOT PLANT FOR SECONDARY TREATMENT AND INJECTION OF DILUTE FISSION PRODUCTS INTO A SHALLOW, LENTICULAR SANDSTONE FORMATION WITH WELL-DEFINED BOUNDARY CONDITIONS. MONITORING FACILITIES AND TECHNIQUES DESIGNED TO DETERMINE HORIZONTAL AND VERTICAL MIGRATION AND DIFFERENTIATION OF THE MIGRATING RADIOISOTOPES ARE DESCRIBED. A PARTIAL COST ANALYSIS IS MADE OF THE PILOT SYSTEM. THE ADVANTAGES AND DISADVANTAGES OF A FULL SCALE SYSTEM OF THIS TYPE, AS COMPARED WITH OTHER METHODS OF DISPOSAL, ARE DISCUSSED. IT IS CONCLUDED THAT THE USE OF SHALLOW SEDIMENTARY FORMATIONS, INCLUDING PARTLY DEPLETED OIL-PRODUCTIVE SANDS, FOR DISPOSING OF RADIOACTIVE WASTES IN SOME AREAS WHERE GEOLOGY PERMITS, IS FEASIBLE AND THAT FIELD PILOT PLANTS TO DEMONSTRATE THAT FEASIBILITY MIGHT BE INSTITUTED WITH INFORMATION AVAILABLE AT THIS TIME.

00820. EXPERIENCE IN BURIAL OF LIQUID RADIOACTIVE WASTES IN DEEP GEOLOGICAL FORMATIONS.

U. S. JOINT PUBLICATION RESEARCH SERVICE, 10 P, 1968 (PB-146 535.

00821. WATER FACILITIES.

REPT. NO. 13, HUD-NJ-P-125-13, 32 P, 1970.

THE REPORT DOES THE FOLLOWING: ANALYZES THE WATER RESOURCES IN THE COUNTY ON LOCAL AND REGIONAL BASES; PROJECTS POPULATION AND WATER DEMANDS FOR THE STUDY PERIOD; ESTABLISHES DESIGN CRITERIA FOR THE VARIOUS ELEMENTS OF THE WATER SYSTEMS; ANALYZES THE EXISTINGWATER SYSTEMS IN THE COUNTY INCLUDING THE ADEQUACY OF EACH TO MEET THE PROJECTEDWATER DEMANDS OVER THE STUDY PERIOD; PROPOSES A REGIONAL SOLUTION OF THE WATER SUPPLY PROBLEMS FOR THE MUNICIPALITIES IN THE NORTHWEST SECTION OF THE COUNTY BYCREATION OF A NORTHWEST SERVICE AREA; DESCRIBES METHODS OF ADMINISTERING THE FACILITIES AND THE FINANCIAL AID AVAILABLE FROM STATE AND FEDERAL SERVICES; ESTIMATES CONSTRUCTION, PROJECT AND ANNUAL AMORTIZATION, OPERATION AND MAINTENANCE COSTS; ESTIMATES COST PER MILLION GALLONS CONSUMED; AND BASED UPON THE FINDINGS OF THE STUDY, DRAWS CONCLUSIONS AND RECOMMENDATIONS WITH THE INTENT OF PROVIDING A GUIDE FOR THE COUNTY TO CONSIDER IN SEEKING A LONG RANGE SOLUTION OF THE WATER SUP PLU PROBLEMS. (PB-200 561).

00822. SEWER FACILITIES.

REPT. NO. 12 HUD-NJ-P-125-12, 43P, 1970.

THE REPORT DOES THE FOLLOWING: ANALYZES THE WASTEWATER COLLECTION AND DISPOSAL PROBLEM AND RECOMMENDS A MASTER PLAN FOR WASTEWATER FACILITIES IN THE COUNTY ON A REGIONAL CONCEPT; ESTABLISHES DESIGN CRITERIA FOR THE VARIOUS ELEMENTS OF THE SEWAGE SYSTEMS; ANALYZES THE EXISTING WASTEWATER FACILITIES IN THE COUNTY; PROPOSES A MASTER PLAN CONSISTING OF FOUR REGIONAL SERVICE AREAS; DESCRIBES METHODS OF ADMINISTERING THE FACILITIES AND FINANCIAL AID AVAILABLE FROM THE STATE AND FEDERAL SOURCES; ESTIMATES CONSTRUCTION PROJECT AND ANNUAL AMORTIZATION, OPERATION AND MAINTENANCE COSTS; ESTIMATES COST PER MILLION GALLONS AND PER EQUIVALENT SERVICE UNIT FOR COLLECTION AND DISPOSAL OF THE WASTEWATERS. (PB-200 573).

00823. BIBLIOGRAPHY OF DESALTING LITERATURE-- 1969.

WONG, C.; GILLAM, W.S.
OSW-PR 552, 469P, 1970.

THE COMPREHENSIVE BIBLIOGRAPHY IS IN THREE SECTIONS. SECTION 1 IS CATEGORIZED WITH 4,925 CITATIONS ARRANGED UNDER THE FOLLOWING MAJOR SUBJECTS: DESALTING PROCESSES, CHEMICAL RECOVERY PROCESSES, DYNAMIC PHENOMENA, DEVELOPMENT

STATUS, MEMBRANES, CHEMICAL PROPERTIES, WATER, AND ENERGY SOURCES. EACH CITATION INCLUDES A REFERENCE NUMBER WHICH IS ASSIGNED SERIALLY. SECTION 2 IS AN AUTHOR INDEX WITH NAMES AND AUTHORS ARRANGED ALPHABETICALLY, FOLLOWED BY TITLES AND REFERENCE NUMBERS OF PERTINENT CITATIONS. REFERENCE NUMBERS CAN BE USED TO LOCATE THE REFERENCE IN SECTION 1, WHERE SOURCE AND DATE PUBLISHED AS SHOWN. SECTION 3 IS A DESCRIPTOR INDEX ARRANGED ALPHABETICALLY AND WITH TITLES OF CITATIONS AND REFERENCE NUMBERS GIVEN UNDER EACH DESCRIPTOR. (PB-201 035).

00824. DESALTING COST CALCULATING PROCEDURES.

PREHN, W.L. JR., ; MCGAUGH, J.L.; WONG, C.; STROBEL, J.J.; MILLER, E.F.
DI-14-01-0001-2260 REPT, 143 P, MAY 1970. (GPO $1.25, I1.88:555.

THE REPORT COMPRISES A MANUAL OF PROCEDURES FOR THE ESTIMATION OF BRACKISH AND SEAWATER DESALTING COSTS BY THE APPLICATION OF ALTERNATIVE DESALTING PROCESSES UNDER DEVELOPMENT BY THE OFFICE OF SALINE WATER, U. S. DEPARTMENT OF THE INTERIOR. THE MANUAL WILL ENABLE THE USER TO CALCULATE CAPITAL, OPERATING AND MAINTENANCE COSTS FOR FIVE (5) PROCESSES AS A PRELIMINARY TO A MORE DETAILED ENGINEERING FEASIBILITY ANALYSIS. THE FIVE PROCESSES FOR WHICH COSTING METHODOLOGY ARE PROVIDED ARE: ELECTRODIALYSIS, REVERSE OSMOSIS, MULTISTAGE FLASH, DISTILLATION, VACUUM FREEZE, AND VAPOR COMPRESSION DISTILLATION. (PB-201 038).

00825. THE ECONOMICS OF QUANTITY VS QUALITY IN GREEN BAY.

ARNOLD, V.L.
PROCEEDINGS OF THE CONFERENCE ON GREAT LAKES RESEARCH (13TH), BUFFALO, N.Y. P141-144, APRIL 1970.

GREEN BAY, A FRESHWATER ESTUARY OF LAKE MICHIGAN, HAS BEEN SELECTED BY THE UNIVERSITY OF WISCONSIN SEA GRANT PROGRAM AS A CASE STUDY OF THE EFFECTS OF MAN'S PURSUIT OF GOODS AND SERVICES ON THE ENVIRONMENT. GREEN BAY SERVES AS A RESOURCE BASE AS WELL AS A MECHANISM BY WHICH GOODS AND SERVICES ARE DISTRIBUTED AND THROUGH WHICH THE BYPRODUCTS OF MANUFACTURING AND AGRICULTURE ARE DISSEMINATED. PHYSICAL, BIOLOGICAL, CHEMICAL, AND SOCIO-ECONOMIC RESEARCH IS CURRENTLY BEING INTEGRATED THROUGH SYSTEM ANALYSIS TO IDENTIFY AND MEASURE IN ECONOMIC AND PHYSICAL TERMS THE COMPLEX INTERRELATIONSHIPS BETWEEN RESOURCE USE OR ABUSE AND THE PHYSICAL ENVIRONMENT. PUBLIC POLICY RECOMMENDATIONS ARE INHERENT IN THIS ANALYSIS AND ALTERNATIVES ARE BEING DEVELOPED WHICH ALLOW PUBLIC DECISION AND POLICY MAKERS TO BE MORE FULLY AWARE OF THE COMPLEX TRADEOFFS BETWEEN QUANTITY AND QUALITY. METHODS FOR ACHIEVING VARIOUS LEVELS OF EACH ARE BEING EXAMINED TO AID IN DECISION-MAKING. (COM-71-00761).

00826. AN ANNOTATED BIBLIOGRAPHY ON THE DESIGN OF WATER RESOURCES SYSTEMS.

ASFUR, H.; YEH, W.W.G.
UCLA-ENG-7104 OWRR-C-1668 3154(1) 88 P. 1971.

AN ANNOTATED BIBLIOGRAPHY OF 126 REFERENCES IS PRESENTED ON THE APPLICATION OF OPERATIONS RESEARCH TECHNIQUES TO DETERMINE THE BEST POSSIBLE SET OF COMPONENTS FOR REGIONAL COMPLEX, MULTIPURPOSE WATER RESOURCES SYSTEMS. THE OPTIMIZATION WAS SUBJECTED TO SEVERAL CONSTRIANTS AND PHYSICAL LIMITATIONS. THE ABSTRACTS ARE CATEGORIZED BY SUBJECT MATTER, INCLUDING AN AUTHOR-SUBJECT INDEX. (W71-09938) (PB-201 005).

00827. THE CHEMICAL INDUSTRY AND POLLUTION CONTROL.

SUB-COUNCIL REPT, 29 P. 1971.

THE REPORT BRIEFLY SURVEYS THE POLLUTION FROM AND THE POLLUTION CONTROL BY THE CHEMICAL INDUSTRY. GPO $0.30/COPY AS 524-0027 (COM-71-50253).

00828. EVALUATION OF NEWLY DEVELOPED ION EXCHANGE MEMBRANES FOR ELECTRODIALYSIS AND/OR TRANSPORT DEPLETION.

PLUMMER, C.W.; ENOS, J.; LACONTI, A.B.; BOYACK, J.R.
OSW-PR-481, 58 P. 1969.

EMPHASIS WAS PLACED ON LONG-TERM ELEVATED TEMPERATURE EVALUATION OF THE FLUORINATED CATIONIC MEMBRANES WITH RESPECT TO STABILITY AND PERFORMANCE DURING LIFE TESTS IN AN ELECTRODIALYSIS STACK AND THE EXTENSIVE DETERMINATION OF THEIR MECHANICAL, PHYSICAL, CHEMICAL AND TRANSPORT PROPERTIES. THE PERFORMANCE OF COMMERCIALLY AVAILABLE MEMBRANES (EITHER CATIONIC OR ANIONIC) AS END COMPARTMENT MEMBRANES WAS SHOWN TO BE UNSATISFACTORY AT EITHER LOW OR HIGH CURRENT DENSITIES, RESULTING IN POOR COULOMBIC EFFICIENCIES AND CROSS-MEMBRANE LEAKAGE. THEIR LACK OF SUFFICIENT ELECTROCHEMICAL AND CHEMICAL STABILITY IN THE 70 DEG C ENVIRONMENT OF THE ANODE AND CATHODE END COMPARTMENTS WAS FOUND TO BE THE CAUSE OF THE POOR PERFORMANCEAND LEAKAGE. ON THE OTHER HAND, BOTH TYPES OF FLUORINATED CATIONIC MEMBRANES FOR END COMPARTMENT USE RETAINED THEIR ACTIVITY AND PERFORMANCE FOR REASONABLE LENGTHS OF TIME AT BOTH LEVELS OF CURRENT DENSITIES. THE COST ANALYSIS, WHICH ASSUMES THE USE OF THESE MEMBRANES FOR END COMPARTMENTS, SHOWED A DISTINCT ADVANTAGE OVER STANDARD REPORTED ELECTRODIALYSIS SYSTEMS. ANOTHER IMPORTANT FINDING DURING THE INVESTIGATION WAS THE UNIQUE ION SELECTIVITY PROPERTIES DISPLAYED BY ONE TYPE OF MEMBRANE DURING ELECTRODIALYSIS WEBSTER WATER OPERATION AND BI-IONIC POTENTIAL MEASUREMENTS MAKING THEM OF INTEREST FOR ION ENRICHMENT OR DEPLETION. (PB-203 116) (GPO $0.60 AS I1.88: 481).

00829. VACUUM FREEZING VAPOR-COMPRESSION PROCESS: ONE AND FIVE MILLION GALLONS PER DAY DESALTING PLANTS.

CONSIE, R.; EMMERMANN, D.; FRASER, J.; JOHNSON, W.
OSW-PR-451, 72 P. 19699.

COST STUDIES HAVE BEEN PREPARED FOR ONE AND FIVE MILLION GPD VACUUM FREEZING VAPOR COMPRESSION DESALTING PLANTS. THESE PLANTS USE 500,000 GPD FACTORY ASSEMBLED UNITS IN GROUPINGS OF TWO AND TEN TO FORM THE DESALTING PLANTS. COSTS FOR 1 AND 5 MILLION GPD PLANTS ARE 61.5 AND 51.3 CENTS PER 1000 GALLONS, RESPECTIVELY. CAPITAL COSTS OF THE PLANTS ARE $1.26 AND $1.10 PER GALLON OF DAILY CAPACITY. THE ESTIMATED POWER CONSUMPTION IS 27 KWH/1000

GALLONS. FULLY AUTOMATIC OPERATION OF THE PLANTS IS ASSUMED THUS REDUCING THE LABOR COSTS TO A MINIMUM. THE 500,000 GPD UNIT IS BASED ON THE USE OF A DIRECT MELTING CONCEPT. (PB-203 382).

00830. PUMPING AND ENERGY RECOVERY SYSTEMS FOR REVERSE OSMOSIS DESALINATION PLANTS.

HICKMAN, K.E.; TRAMONI, J.P.; GANLYE, J.T.; FAHIMIAN, E.J.
OSW-PR-457, 282 P, 1969.

THE REPORT COVERS A SURVEY OF PUMPING AND ENERGY RECOVERY EQUIPMENT FOR REVERSE OSMOSIS DESALINATION PLANTS AND IDENTIFIED AREAS IN WHICH FURTHER RESEARCH AND DEVELOPMENT WORK IS DESIRED IN ORDER TO IMPROVE THE OPERATING CHARACTERISTICS AND ECONOMICS OF THE RESPECTIVE SYSTEMS. FACTORS THAT INFLUENCE WATER COST WERE ANALYZED. (PB-203 836).

00831. DEVELOPMENT OF MATHEMATICAL MODEL AND COMPUTER PROGRAM FOR OPTIMIZATION OF VTE SALINE WATER PLANTS.

DUKLER, A.E.; HUANG, C.J.; LEE, M.L.
OSW-PR-404, 170 P, 1969.

TECHNIQUES AND MATHEMATICAL MODELS WERE DEVELOPED FOR AN OPTIMUM DESIGN OF A VTE DESALTING PLANT. THE OPTIMIZATION SYSTEM IS THEN PROGRAMMED INTO AN ELECTRONIC COMPUTER WHICH AUTOMATICALLY SEARCHES AND ARRIVES AT AN OPTIMUM DESIGN. THE COMPUTER PROGRAM IS VERY FLEXIBLE AND VERSATILE. THE COMPLETE SYSTEM IS DIVIDED INTO 4 MAJOR SUBSYSTEMS WHICH ARE MULTISTAGE EVAPORATOR PROCESS SIMULATION, ENGINEERING DESIGN SIMULATION, CAPITAL AND OPERATING COST CALCULATION, AND OPTIMUM SEARCHING TECHNIQUES. THE ENGINEERING DESIGN SIMULATION AND THE CAPITAL AND OPERATING COST CALCULATION ARE BASED ON THE DESIGN CONCEPT OF A MULTISTAGE EVAPORATOR SYSTEM ARRANGED INTO THE CONCENTRIC GEOMETRIC CONFIGURATION. MODIFICATION OF THESE SUBSYSTEMS FOR OTHER GEOMETRICAL ARRANGEMENTS CAN BE ACCOMPLISHED READILY AND WITH LITTLE DIFFICULTY. INSTRUCTIONS ARE GIVEN FOR PREPARING THE INPUT DATA CARDS AS WELL AS OPERATING THE SYSTEM. THE SOURCE PROGRAM IS WRITTEN IN FORTRAN IV. (PB-203 839).

00832. ECONOMICS OF AIR AND WATER POLLUTION.

WALKER, W.R.
HEW BULL-26, 256 P, 1969.

IN THE SEMINAR AN INITIAL EFFORT WAS MADE TO BRIDGE A PORTION OF THE GAP BETWEEN THE TECHNICAL AND ECONOMIC AREAS. THE TOPICS DISCUSSED INCLUDE THE FOLLOWING: EXTERNALITIES AND THE QUALITY OF AIR AND WATER; PUBLIC VS PRIVATE GOODS; MARKET FAILURE-- WHY EXTERNALITIES ARE NOT ACCOUNTED FOR IN THE MARKET; EFFLUENT CHARGES; THE USE OF SUBSIDIES FOR WASTE ABATEMENT; MARKET MODIFICATIONS AND THE GOVERNMENT GRANTS ECONOMY; CONTROL--LAWS AND REGULATIONS--PROPERTY RIGHTS; COST BENEFIT ANALYSIS. (PB-195 423).

00833. PARAMETRIC ECONOMIC AND ENGINEERING EVALUATION STUDY OF THE ELECTRODIALYSIS PROCESS FOR WATER DESALINATION.

CHRISTODOULOU, A.P.; OLSSON, G.R.; MONNIK, H.J.
OSW-PR-488, 271 P, 1969.

A PARAMETRIC ENGINEERING AND ECONOMIC ANALYSIS OF THE ELECTRODIALYSIS PROCESS WAS PERFORMED IN WHICH WATER COSTS WERE EXAMINED FOR THE DEMINERALIZATION OF THREE REFERENCE BRACKISH WATERS. CAPITAL COSTS WERE BASED ON SCALED-UP STACK DESIGNS OF BOTH THE TORTUOUS PATH AND SHEET FLOW TYPES AND ON DETAILED PLANT DESIGNS. OPERATING COSTS WERE BASED ON BOTH STATE OF THE ART TECHNOLOGY AND ON PROJECTED TECHNOLOGICAL IMPROVEMENTS IN CRITICAL COMPONENTS AND PROCESS PARAMETERS. A COMPUTATIONAL ALGORITHM FOR ELECTRODIALYSIS PROCESS ANALYSIS AND COSTING WAS DEVELOPED AND PROGRAMMED. (PB-203 123).

00834. VACUUM FREEZING VAPOR COMPRESSION DESALTING STATE-OF-THE-ART (1968).

OSW-PR-491, 65 P, 1969.

THE STATE OF VACUUM FREEZING VAPOR COMPRESSION (VFVC) TECHNOLOGY IS EVALUATED AND ANALYZED, CONSIDERING PROCESS THEORY, DESIGN, AND ECONOMIC COST. THE VFVC PROCESS IS A FEASIBLE, RELIABLE PROCESS FOR DESALTING BRACKISH AND SEA WATERS. NO CHEMICAL TREATMENT IS REQUIRED TO CONTROL SCALE FORMATION. THE COST OF A 100,000 GPD UNIT OPERATING ON SEA WATER IS LESS THAN $3.00 PER GPD OF INSTALLED CAPACITY. A 100,000 GPD VFVC PLANT IS COMMERCIALLY AVAILABLE. THESE PLANTS WILL BE IMPROVED BY USING THE DIRECT MELTING CONCEPT WHICH ALLOWS THE MAIN ASPECTS OF THE DESALTING PROCESS TO BE PERFORMED IN ONE VESSEL. THIS IMPROVEMENT WILL REDUCE THE OPERATING COST OF THE PROCESS. (PB-203 126).

00835. ECONOMICS OF SEAWATER DESALTING IN COMBINATION WITH AMMONIA AND POWER PRODUCTION.

BRESLER, S.A.
OSW-PR-458, 191 P, 1969.

THE FEASIBILITY OF LOWERING THE OPERATING COST OF PRODUCING DESALTED WATER BY COMBINING ITS PRODUCTION WITH AMMONIA AND ELECTRICITY WAS EXAMINED. THE COST OF PRODUCING DESALTED WATER FROM SEA WATER IN A SINGLE-PURPOSE MULTISTAGE FLASH DISTILLATION (MSF) PLANT CAN BE REDUCED ALMOST 30% BY COMBINING ITS PRODUCTION WITH THAT OF AMMONIA, TO ABOUT 27 TO 35 CENTS PER THOUSAND GALLONS IN PLANTS OF CAPACITIES RANGING FROM 12.5 TO 150 MGD. THE USE OF A COMMON ENERGY CENTER PERMITS THE DESIGN OF PLANTS HAVING A WIDE RANGE OF RELATIVE CAPACITIES OF AMMONIA, DESALTED WATER AND/OR ELECTRIC POWER, RESULTING IN FURTHER POSSIBLE REDUCTIONS OF UNIT WATER COSTS. THE USE OF NUCLEAR ENERGY STARTS TO BECOME ECONOMICALLY ATTRACTIVE WHEN THE COST OF NATURAL GAS OR OTHER HYDROCARBON FUEL EXCEEDS 25 CENTS PER MILLION BTU. (PB-203 269).

REFERENCE LIST

00836. COORDINATION OF INDUSTRIAL AIR AND WATER QUALITY PROGRAMS AS AN EFFECTIVE MANAGEMENT POLICY.

TIHANSKY, D.P.
RAND CORP REPORT P-4551, 6 P, 1971.

THE PAPER RECOMMENDS THE COORDINATION OF AIR AND WATER QUALITY MANAGEMENT PROGRAMS IN INDUSTRY AS AN EFFECTIVE APPROACH FOR THE MINIMIZATION OF ABATEMENT EXPENDITURES AS WELL AS SCHEDULE DELAYS IN MEETING POLLUTION CONTROL REGULATIONS. COMPLEMENTARITY OF WASTE TREATMENT PROJECTS IS EVALUATED IN TERMS OF BOTH REGIONAL (OUT-OF-PLANT) AND INTRAFIRM ADVANTAGES. (AD-731 261).

00837. POLLUTION CONTROL IN STEELMAKING: FACT OR FICTION.

TIHANSKY, D.P.
RAND CORP REPORT P-4552, 7 P, 1971.

WITH CURRENT EMPHASIS AND LEGISLATION DIRECTED TOWARD IMPROVEMENT OF THE QUALITY OF ENVIRONMENT, THE PAPER BRIEFLY EXAMINES THE PROGRESS OF ONE OF THE LARGEST WASTE GENERATORS--THE AMERICAN STEEL INDUSTRY--IN ITS ABATEMENT RESEARCH AND CONSEQUENT AIR AND WATER QUALITY CONTROL PROGRAMS. PUBLIC CONCERN ABOUT STEELMAKING WASTE DISCHARGES IS EMPHASIZED, AND SOME ECONOMIC AND TECHNICAL DIFFICULTIES IN MEETING ABATEMENT STANDARDS IN STEEL PLANTS ARE IDENTIFIED. AGGREGATE COST DATA RELATED TO THE INSTALLATION, OPERATION, AND MAINTENANCE OF WASTE CONTROL EQUIPMENT ARE REVIEWED, AND THE SIGNIFICANCE OF THESE EXPENDITURES REVEALS THE STEEL INDUSTRY'S POSITIVE RESPONSE TO POLLUTION CONTROL REGULATIONS. (AD-731 262).

00838. SECONDARY REFRIGERANT FREEZING DESALTING PROCESS OPERATION OF A 15, 000 GPD PILOT PLANT.

GANIARIS, N.; LAMBIRIS, J.; GLASSER, R.
OSW-PR-416, 108 P, 1969.

THE DEVELOPMENT OF THE SECONDARY REFRIGERANT FREEZING PROCESS IN A 15,000 GPD PILOT PLANT IS DESCRIBED. THE RESULTS OF THE EXPERIMENTAL PROGRAM DEMONSTRATED THAT THE PROCESS WAS TECHNICALLY FEASIBLE AT THE 15,000 GPD PILOT PLANT LEVEL. PRODUCT WATER WITH LESS THAN 500 PPM TDS AND LESS THAN 0.20 PPM OF DISSOLVED HYDROCARBON WAS PRODUCED ON A CONTINUOUS BASIS. SPARGING HYDROCARBON REFRIGERANT (BUTANE) INTO PRECOOLED SEA WATER RESULTED IN THE PRODUCTION OF ICE CRYSTALS GREATER THAN 1.0 MM DIAMETER HIGHER VOLUMETRIC ICE PRODUCTION RATES, AND LOWER ENTRAINMENT OF BUTANE IN THE ICE SLURRY. WASHING THE ICE COUNTERCURRENTLY ACCORDING TO THE HYDRAULIC PISTON-BED DISPLACEMENT METHOD RESULTED IN THE PRODUCTION OF POTABLE WATER. WASH COLUMN RATES OF ABOUT 2100 GPD/SQ FT WERE ACHIEVED IN THE PILOT PLANT WASH COLUMN. ON THE BASIS OF PILOT PLANT PERFORMANCE, THE COST OF WATER FOR PLANTS WITH CAPACITIES OF 1.0 TO 10 MILLION GPD IS IN THE RANGE OF $1.00 TO $0.45 PER 1000 GALLONS. (PB-203 841).

00839. A COST EFFECTIVENESS STUDY ON PRETREATMENT METHODS FOR MEMBRANE DESALTING PLANTS.

KNEALE, J.S.; KELLEY, E.M.
PERMUTIT CO., PRINCETON, N.J., 376 P, MAY 1969. (GPO.

AN ENGINEERING STUDY HAS BEEN MADE TO DETERMINE THE COST EFFECTIVENESS OF PRETREATMENT SYSTEMS FOR MEMBRANE DESALTING PROCESSES. THE REPORT DETAILS THE EQUIPMENT AND CHEMICALS REQUIRED, WASTE PRODUCTS PRODUCED, CHEMICAL OPERATING COSTS, TOTAL OPERATING COSTS AND INSTALLED PLANT EQUIPMENT COSTS FOR FLOW RATES OF 0.25, 1.0, 5.0, 10.0 AND 50.0 MGD. FOUR BRACKISH WATERS OF DIFFERENT CHARACTERISTICS ARE TREATED TO HARDNESS LEVELS OF 50 PPM, 200 PPM AND A CALCIUM LEVEL TO AVOID PRECIPITATION (BY EITHER THE HOT OR COLD PROCESS). REDUCTION OF IRON AND MANGANESE IS CONSIDERED SEPARATELY WITH NO HARDNESS REDUCTION INCLUDED. (PB-203-849).

00840. POLLUTION CONTROL AND MANAGEMENT.

NEW ENGLAND REGIONAL COMMISSION, 495 P, 1969.

THE REPORT REVIEWS, ORGANIZES, AND ANALYZES INFORMATION ON WASTE GENERATION AND DISPOSAL FOR USE IN POLLUTION MANAGEMENT IN NEW ENGLAND. THE CONTENTS INCLUDE THE FOLLOWING TOPICS: (I) SOLID WASTE MANAGEMENT (INCINERATION, LANDFILLS, OPEN BURNING, WASTE COLLECTION, COSTS, LEGISLATION, FORECASTS, RECYCLING); (II) AIR POLLUTION MANAGEMENT (TYPES, AUTOMOBILES, POWER GENERATION, CONTROL, SULFUR DIOXIDE, NUCLEAR POWER PLANTS, LEGISLATION); (III) WATER POLLUTION MANAGEMENT (MUNICIPAL WASTES, PAPER INDUSTRY, TEXTILE MILLS, POTATO PROCESSING, FISHING, METAL INDUSTRIES). (COM-71-00061).

00841. SUMMARY OF COMMERCIAL WASTE WATER TREATMENT PLANTS.

MAHONEY, J.A.
AIR FORCE WEAPONS LABORATORY, KIRKLAND AIR FORCE BASE, NEW MEXICO, 60 P, SEPTEMBER 1969.

THE PURPOSE OF THE REPORT IS TO CATALOG AND REVIEW CAPABILITIES OF COMMERCIALLY AVAILABLE PACKAGED WASTE WATER TREATMENT PLANTS FOR POSSIBLE AIR FORCE APPLICATION IN LIMITED WAR AND FIXED BASE INSTALLATIONS. DEFINITIONS OF THE VARIOUS METHODS OF TREATMENT ARE INCLUDED. SIMPLE CURVES ARE FURNISHED FOR A QUICK ESTIMATE OF COSTS, POWER REQUIREMENTS, ERECTION TIME, SHIPPING VOLUME AND WEIGHT IN RELATION TO FLOW CAPACITY. INCLUDED ARE TABLES WHICH RELATE THE PERFORMANCES OF A NUMBER OF PLANTS TESTED BY THE NATIONAL SANITATION FOUNDATION, BY THE MANUFACTURER, AND BY THE FLORIDA STATE BOARD OF HEALTH. A LIST OF FIRMS WHICH MANUFACTURE PACKAGED WASTE WATER TREATMENT PLANTS IS INCLUDED IN AN APPENDIX. (AD-860 067).

COST ANALYSIS OF WATER POLLUTION CONTROL

00842. COLLECTION, REDUCTION AND DISPOSAL OF SOLID WASTE IN HIGH-RISE MULTIFAMILY DWELLINGS.

EPA-SW-27C2-71, 184 P, 1971.

THE REPORT DISCUSSES THREE ALTERNATIVE METHODS OF HANDLING SOLID WASTE IN HIGH-RISE MULTIFAMILY HOUSING: INCINERATION, COMPACTION, AND WET PULVERIZATION. THIS INTERIM REPORT PRESENTS, IN NARRATIVE FORM, THE RESULTS OF THE FIRST STUDY PERIOD OF THE THREE-STUDY-PERIOD PROGRAM. CONCLUSIONS AND RECOMMENDATIONS ARE YET TO BE FORMULATED. THE REPORT COVERS: (1) THE OBJECTIVES AND SCOPE OF THE PROJECT, (2) THE WORK TO BE ACCOMPLISHED DURING EACH OF THE STUDY PERIODS, (3) THE METHOD OF CONDUCTING THE PROJECT, AND (4) THE TEST STRUCTURES USED. IN ADDITION, THE EXISTING CONDITIONS AT THE TEST STRUCTURES ARE ASSESSED, INCLUDING THE QUANTITY AND COMPOSITION OF THE REFUSE, THE NUMBER AND AGE OF THE TENANTS, THE CONTRIBUTION TO AIR POLLUTION BY INCINERATORS, THE DEGREE OF VERMIN AND INSECT INFESTATION, THE PERSONNEL AND POWER REQUIREMENTS, THE COST, THE EFFECTIVENESS AND LIMITATIONS, AND THE ACCEPTANCE BY OWNERS, TENENTS, AND CUSTODIANS. THE TENTATIVE DATA-COLLECTION PROGRAM AND REFUSE-HANDLING EQUIPMENT TO BE INSTALLED FOR THE SECOND STUDY PERIOD ARE DISCUSSED. (PB-197 623).

00843. BRINE DISPOSAL POND MANUAL.

DAY, M.E.; ARMSTRONG, E.L.; WONG, C.; SAVAGE, W.F.; GRANSEE, C.L.
OSW-PR-588, 149 P, 1970.

THE MANUAL COVERS THE DESIGN AND CONSTRUCTION OF BRINE DISPOSAL PONDS FOR USE IN DISPOSING OF WASTE BRINE FROM INLAND DESALTING PLANTS. SPECIFIC DESIGN CRITRIA ARE PRESENTED FOR A HYPOTHETICAL BRINE DISPOSAL POND SYSTEM BASED ON DATA FROM THE VICINITY OF ROSWELL, NEW MEXICO. ESTIMATES OF THE COST OF VARIOUS SIZES OF MULTIPLE POND SYSTEMS ARE MADE BASED ON THE DESIGN CRITERIA ASSUMED FOR THE ROSWELL SITE. OPERATION AND MAINTENANCE REQUIREMENTS WHICH AFFECT THE PLANNING OF A BRINE DISPOSAL SYSTEM ARE INCLUDED. THE MANUAL PRESENTS DATA ON VARIOUS LININGS CONSIDERED SUITABLE FOR PONDS AND GIVES CONSTRUCTION INFORMATION FOR LINING INSTALLATION. A SUMMARY OF THE REGULATIONS OF VARIOUS STATES WITH RESPECT TO PONDING IS INCLUDED AS AN APPENDIX. (PB-198 938).

00844. FUTURE WATER DEMANDS.

HOWE, C.W.; RUSSELL, C.S.; YOUNG, R.A.; VAUGHAN, W.J.
NATIONAL WATER COMMISSION, NWC-EES-71-001, 116 P, 1971.

THE REPORT SUMMARIZES 3 STUDIES ON WATER DEMANDS: (1) URBAN, (2) INDUSTRIAL, AND (3) AGRICULTURAL; IT ANALYZES THE EFFECTS OF LIKELY MARKET TRENDS, PUBLIC POLICIES, AND TECHNOLOGICAL CHANGE ON WATER USE AND WATER POLLUTION. PROJECTIONS ARE GIVEN. (1) THE URBAN STUDY FOCUSES ON RESIDENTIAL DEMANDS, BUT COMMERCIAL DEMANDS ARE ALSO TREATED. WAYS TO REDUCE LOSSES FROM MUNICIPAL WATER SYSTEMS ARE ANALYZED THOROUGHLY. (2) THREE INDUSTRIES ARE ANALYZED IN DETAIL: THERMAL ELECTRIC POWER, BEET SUGAR REFINING, AND PETROLEIUM REFINING. IN EACH INDUSTRY THE WITHDRAWALS, CONSUMPTION, AND WASTELOAD PATTERNS OF A REPRESENTATIVE PLANT ARE STUDIED AS FUNCTIONS OF WATER PRICE, WATER QUALITY STANDARDS OR EFFLUENT CHARGES, INPUT QUALITIES, AND OUTPUT MIXES. (3) THE RESPONSES OF WATER USE TO WATER PRICING, FARM PROGRAMS, AND TECHNOLOGY ARE TRACED FOR TYPICAL FARMS IN 3 MAJOR IRRIGATION AREAS: THE LOWER COLORADO BASIN, CENTRAL ARIZONA, AND THE HARD SOILS SECTION OF THE TEXAS HIGH PLAINS. (PB-197-877).

00845. REAERATION OF STREAMS AND RESERVOIRS ANALYSIS AND BIBLIOGRAPHY.

KING, D.L.
REC-OCE-70-55, 140 P, 1970.

A LITERATURE SEARCH AND STATE-OF-THE-ART REVIEW TO DETERMINE THE NEED FOR FUTURE RESEARCH IN REAERATION OF STREAMS AND RESERVOIRS REVEALED A LARGE NUMBER OF REFERENCES CONCERNING THE APPLICATION OF AERATION METHODS AND EQUIPMENT TO WASTE TREATMENT. GENERALLY, THE APPLICATION OF THIS TECHNOLOGY TO AERATION OF LARGE VOLUMES OF WATER SUCH AS RIVERS AND RESERVOIRS REMAINS TO BE DEVELOPED. (PB-197 877).

00846. PRIORITY AND PLANNING ELEMENTS FOR DEVELOPING ILLINOIS WATER RESOURCES.

ILLINOIS STATE DEPT. OF BUSINESS AND ECONOMIC DEVELOPMENT, 53 P, MAY 1970.

PRIORITIES AND TECHNIQUES OF ANALYSIS ARE DEVELOPED IN A COORDINATED PLAN TO GUIDE ILLINOIS INVESTMENT IN MAJOR WATER RESOURCE ACTIVITIES INVOLVING STATE PROGRAMS OR DEVELOPMENTAL RESPONSIBILITIES. STATE GUIDELINES FOR ADMINISTRATIVE EVALUATION AND FOR EXPEDITING SPECIFIC PROPOSALS ARE DEFINED. THESE ADMINISTRATIVE TOOLS ARE DESIGNED TO SPEED ACCURATE EVALUATION AND PROCESSING OF BOTH STATE AND FEDERAL DEVELOPMENT ACTIVITIES. COORDINATED GUIDELINES AND A SYSTEM OF PRIORITIES ARE PRESENTED TO FACILITATE THE ADMINISTRATION OF FEDERAL OR STATE FINANCIAL ASSISTANCE TO LOCAL COMMUNITIES FOR EACH OF THE WATER RESOURCE RELATED PROGRAMS. MAJOR EMPHASIS IS PLACED ON THE SELF-HELP FINANCIAL NEED VALUES. (PB-196 814.

00847. A STUDY ON DESIGN AND COST ANALYSIS OF A PROTOTYPE COAL CLEANING PLANT. PART I-6.

APTD-0606, 193 P, 1969.

THE REPORT PRESENTS THE RESULTS OF RESEARCH IN WHICH THE FOLLOWING POINTS WERE TO BE INVESTIGATED: TO STUDY APPROXIMATELY 200 SETS OF COAL WASHABILITY DATA FROM WHICH TO EVALUATE AND CLASSIFY COAL SUITABLE FOR PRODUCING A CLEAN COAL WITH DIFFERENT SULFUR CONTENT; TO DEVELOP A SCHEME OF RANKING FOR THESE COALS; TO DEVELOP A DESIGN FOR THE MOST APPROPRIATE, CONVENTIONAL TYPE COAL CLEANING PLANT TO REMOVE SULFUR COMPOUNDS; TO DEVELOP THE INSTALLED COST OF THE PLANT, AND ESTIMATED COSTS FOR THE OPERATION OF THE PLANT. (PB-196 631).

REFERENCE LIST

00848. A STUDY ON DESIGN AND COST ANALYSIS OF A PROTOTYPE COAL CLEANING PLANT. SUPPLEMENT.

APTD-0609, 14 P, 1969.

FOUR ALTERNATE METHODS SUGGESTED IN THE REPORT WHICH THIS ONE SUPPLEMENTS ARE EXPLAINED IN DETAIL. THE MOST ECONOMICAL METHOD TO DETERMINE THE REDUCTION OF SULFUR FROM A GIVEN RAW COAL IS BASED ON BENEFICIATION EQUIPMENT CURRENTLY USED BY COAL WASHING CONTRACTORS; IT INVOLVES EXTENSIVE LABORATORY TESTING FROM SUITABLE RAW COAL SAMPLES. (PB-196-634).

00849. AN ECONOMIC AND ENGINEERING ANALYSIS OF THE ELECTRODIALYSIS PROCESS.

PORTER, J.W.; CHERNEY, S.
OSW-PR-470, 192 P, 1969.

THE ELECTRODIALYSIS PROCESS WAS STUDIED IN PLANTS OF 1, 10, AND 50 MILLION GALLONS PER DAY CAPACITY, TREATING EACH OF 3 REFERENCE BRACKISH WATERS. THE PLANTS USED BOTH REINFORCED AND UNREINFORCED MEMBRANES. A COMPUTER ALGORITHM WAS DEVELOPED TO PERFORM NECESSARY PROCESS AND PLANT DESIGN CALCULATIONS IN ORDER TO PROVIDE CAPITAL AND WATER COSTS FOR EACH PLANT. THE CALCULATED INFORMATION INCLUDES: THE EFFECT OF POWER COST AND FEEDWATER TEMPERATURE ON DESALTED WATER COSTS; AN ANALYSIS OF CRITICAL COMPONENTS AND THEIR EFFECT ON DESALTED WATER COSTS, AND THE EFFECT ON DESALTED WATER COSTS OF CERTAIN PROJECTED TECHNOLOGY ITEMS. (PB-203 280).

00850. A STUDY OF DEEP-WELL DISPOSAL OF DESALINATION BRINE WASTE.

LEGROS, P.G.; GUSTAFSON, C.E.; NEVILL, G.L.; MAJESKE, E.C.; MATHEWS, R.D.
OSW PR-456, 271 P, 1969.

SEVEN INLAND U. S. COMMUNITIES WERE SELECTED AS EXAMPLES FOR THE DESIGN OF DEEP WELL DISPOSAL FACILITIES FOR THE DESALINATION OF WASTE BRINES. THE WATER NEEDS, THE GEOLOGICAL STRUCTURES, AND OTHER PERTINENT DATA WERE ACCUMULATED FOR EACH OF THE SEVEN COMMUNITIES. ACTUAL VALUES WERE USED WHEREVER AVAILABLE. INJECTION WELLS AND SURFACE EQUIPMENT WERE DESIGNED FOR EACH COMMUNITY, AND ESTIMATES WERE MADE OF THE COST OF CONSTRUCTION AND OPERATION OF THE DESIGNED DISPOSAL SYSTEM IN EACH. THE DEVELOPED COSTS VARY FROM A LOW OF 2.5 CENTS PER 1000 GALLONS OR PRODUCT WATER AT ARKANSAS CITY TO A HIGH OF 25.1 CENTS AT FORT MORGAN. THIS SPREAD IN COSTS REPRESENTS THE EXPECTED RANGES DUE TO VARIATIONS IN GEOLOGY, GEOGRAPHY AND PLANT SIZE. (PB-203 268).

00851. OPERATION OF THE MULTI-EFFECT MULTISTAGE FLASH DISTILLATION PLANT (CLAIRENGLE).

OSW-PR-668, 538 P, 1971.

THE DOCUMENT CONTAINS A GENERAL DISCUSSION CONCERNING THE MANAGEMENT, OPERATION, MAINTENANCE, PHYSICAL PLANT, AND INFORMATION GAINED IN THE OVERALL PROGRAM OF ADVANCING THE STATE OF THE ART OF DESALTING TECHNOLOGY. THE PLANT IS A 1,000,000 GALLON PER DAY, HIGH PERFORMANCE, SEA WATER DESALINATION PLANT. THE PLANT IS DESIGNED TO PROVIDE MEANINGFUL DATA CONCERNING THE DESIGN AND OPERATION OF LARGE DESALINATION PLANTS INCLUDING SUCH ITEMS AS HEAT TRANSFER, EQUIPMENT AND STRUCTURAL DESIGN, MATERIALS, COST OF PROVIDING FRESH WATER, PROCESS ENGINEERING INCLUDING HIGH TEMPERATURE OPERATION, OPERATION OF MULTIPURPOSE PLANTS, AND EQUIPMENT PERFORMANCE. (PB-202 757).

00852. CONCEPTUAL DESIGN STUDY ON ELECTRODIALYSIS MEMBRANE ASSEMBLY MODULAR UNIT DESIGN.

SCHECTER, J.; FORGACS, C.
OSW PR-681, 104 P, 1971.

TWO ALTERNATIVE TYPES OF A NEW ELECTRODIALYSIS MEMBRANE ASSEMBLY MODULAR UNIT ARE PRESENTED. THESE UNITS UTILIZE TWO CONCEPTS, NAMELY, THE CROSS FLOW OF THE TWO PROCESS STREAMS AND THE THIN AND SHORT DILUATE COMPARTMENT. DETAILED DESIGN PERFORMANCE DATA AND COST ESTIMATES ARE GIVEN. THE NEW UNITS SEEM SUPERIOR TO THOSE IN CURRENT PRACTICAL USE. THEIR MAIN FEATURE IS THAT THEY ENABLE SINGLE STAGE DESALINATION OF ALMOST ANY TYPE OF BRACKISH WATER. APPROXIMATE ECONOMIC CALCULATIONS SHOW THAT BRACKISH WATER CAN BE DESALINATED IN LARGE ELECTRODIALYSIS PLANTS BASED ON THESE MODULAR UNITS AT A TOTAL PRODUCTION COST OF 28-32 CENTS/1000 GAL (DEPENDING ON MEMBRANE PRICE) IN 1 MGD PLANTS, AND AT 16-19 CENT/1000 GAL IN 50 MGD PLANTS (EXCLUDING SCALE CONTROL). THE TOTAL CAPITAL COST PER GALLON PER DAY PRODUCTION WOULD BE 47-53 CENTS. (PB-202 770).

00853. AN EVALUATION OF THE PROBLEMS OF SANITARY SEWER SYSTEM DESIGN.

GEYER, J.C.; LENTZ, J.J.
FHA-564, 114 P, 1969.

GENERAL PROBLEMS FACING SEWER DESIGNERS HAVE BEEN STUDIED USING FIELD DATA COLLECTED IN FOUR U. S. COMMUNITIES. ANALYSIS OF THESE DATA INDICATES THAT BASIC CAUSES OF MAINTENANCE DIFFICULTIES ARE TREE ROOTS, ACCUMULATIONS OF DEBRIS IN THE ABSENCE OF ROOTS, OTHER CAUSES, AND IN AREAS HAVING COHESIONLESS SUBSOIL, SEWER CAVE-INS. PROPORTIONATELY FEWER BLOCKAGES OCCUR WHEN GRADES ARE MODERATE, AND PROPORTIONATELY FEWER BLOCKAGES OCCUR WHEN GRADES ARE MODERATE, AND PROPORTIONATELY MORE OCCUR AT THE UPPER TERMINALS OF THE SEWERS. IN EIGHT-INCH PIPE, MANHOLE SPACING HAS LITTLE EFFECT ON THE LABOR COSTS OF STOPPAGE RELIEF. EMPHASIS IS PLACED ON STATISTTICAL TECHNIQUES FOR ESTIMATING DOMESTIC SEWAGE FLOW. FLOW OF RAINWATER AND GROUNDWATER WAS AT TIMES FOUND TO BE EXCESSIVE IN ALL SYSTEMS STUDIED. LIMITED DATA ON COSTS OF OPERATING AND MAINTAINING SEWAGE PUMPING STATIONS ARE REPORTED AND EVALUATED. (PB-180 509).

00854. FEASIBILITY OF CURVILINEAR ALIGNMENTS FOR RESIDENTIAL SANITARY SEWERS.

FHA-704, 224 P, 1959.

THE REPORT SUMMARIZES A STUDY COMPRISING AN INVESTIGATION AND EVALUATION OF THE USE IN THE UNITED STATES OF CURVED OR CURVILINEAR ALIGNMENTS FOR RESIDENTIAL SANITARY SEWERS, AS DISTINGUISHED FROM THE CONVENTIONAL PRACTICE WHEREIN ONLY STRAIGHT RUNS ARE ALLOWED BETWEEN MANHOLES. THE PRIMARY OBJECTIVE WAS TO ASCERTAIN THE FEASIBILITY OF CURVED ALIGNMENTS ON THE BASIS OF ACTUAL EXPERIENCE IN COMMUNITIES WHERE SUCH ALIGNMENTS HAVE BEEN USED. (PB-180 868).

00855. PRELIMINARY WATER PLAN FOR THE BALTIMORE REGION.

LEARY, A.G.
REGIONAL PLANNING COUNCIL, BALTIMORE, MD., 89 P, 1968.

THE REPORT PRESENTS A PRELIMINARY LONG-RANGE WATER SUPPLY PLAN FOR THE BALTIMORE REGION, ALONG WITH A CORRESPONDING TWENTY-YEAR CAPITAL PROGRAM FOR CONSTRUCTION OF WATER TREATMENT AND DISTRIBUTION FACILITIES. THE PLAN AND PROGRAM INCLUDES FACILITIES OF REGIONAL AS WELL AS LOCAL SIGNIFICANCE. THE TWENTY-YEAR CAPITAL PROGRAM IS FURTHER SEPARATED INTO TWO STAGES: THE INITIAL FIVE-YEAR PROGRAM, AND THE SUBSEQUENT FIFTEEN-YEAR PROGRAM. (PB-182 124).

00856. WATER SUPPLY AND SANITARY SEWERAGE. ANDERSON, SOUTH CAROLINA.

PREPARED IN COOPERATION WITH THE PLANNING AND ZONING COMMISSION OF ANDERSON, SOUTH CAROLINA, 47 P, 1968.

THE PURPOSE OF THE REPORT IS TO OUTLINE THOSE FACILITIES WHICH WILL BE NEEDED TO PROVIDE POTABLE WATER AND COLLECT AND PROPERLY DISPOSE OF WASTED WATER IN THE ANDERSON URBAN AREA BETWEEN THE PRESENT AND 1985. PREVIOUS SECTIONS OF THE ANDERSON COMPREHENSIVE PLAN, PARTICULARLY POPULATION AND LAND USE STUDIES, WERE USED AS A BASIS FOR ESTABLISHING TH 1985 LIMITS OF SERVICE. (PB-182 501).

00857. A STUDY TO DETERMINE THE COSTS OF WATER IN INDUSTRIAL USES.

BRAMER, H.C.; MOTZ, D.J.
RICE AND CO., PITTSBURG, PA., 163 P, 1968.

COMPREHENSIVE WATER RESOURCES PLANNING REQUIRES EVALUATION OF ALTERNATIVES IN TERMS OF ECONOMIC AND SOCIAL CONSEQUENCES. ULTIMATELY, SOME JUDGMENT AS TO THE OPTIMUM OR BEST OF THE FEASIBLE ALTERNATIVES MUST BE MADE. COSTS AND BENEFITS MUST BE EXPRESSED IN DOLLAR AMOUNTS IF USEFUL ECONOMIC EVALUATIONS ARE TO BE MADE. ECONOMIC STUDIES THAT ARE NOT QUANTITATIVE IN THIS SENSE DO NOT GIVE THE RESOURCES PLANNER THE INFORMATION REQUIRED FOR DECISION MAKING IN SPECIFIC CASES. THE PRESENT STUDY HAS SOUGHT TO PROVIDE A METHOD BY WHICH NEEDED QUANTITATIVE COST INFORMATION CAN BE OBTAINED AND FORMATTED INSOFAR AS INDUSTRIAL WATER USES ARE CONCERNED; SUCH INFORMATION HAS NOT BEEN AVAILABLE EXCEPT IN SUPERFICIAL, NON-CRITICAL TABULATIONS OR IN SCATTERED REFERENCES TO UNDEFINED COSTS. EVEN WITHIN FIRMS, INDUSTRIAL WATER COSTS ARE USUALLY UNKNOWN. AVAILABLE DATA ARE NOT IN ANY UNIFORM FORMAT AND COST FACTORS ARE NOT WELL DEFINED. THE METHODOLOGY HEREIN WILL BE OF USE IN DETERMINING WATER COSTS AS A MANAGEMENT TOOL WITHIN THE FIRM, I. E., AS A FACTOR IN DETERMINING AND CONTROLLING MANUFACTURING COSTS AND THUS RESULTING IN MORE EFFICIENT USE OF WATER RESOURCES. (PB-182 856) (W69-03322).

00858. SANITARY SEWERAGE AND SEWAGE TREATMENT FOR AMARILLO, 1967.

AMARILLO PLANNING AND ZONING COMMISION, 150 P, 1968.

THE REPORT SERVES AS A CONSOLIDATION OF CAPITAL IMPROVEMENT COSTS AND TIMING OF CONSTRUCTION FOR WATER, SEWER, AND SURFACE DRAINAGE. ALSO CONTAINED IN THIS REPORT IS AN ANALYSIS OF THE PRESENT RATE STRUCTURE FOR WATER AND SEWER. RECOMMENDATIONS ARE MADE FOR RATE CHANGES AS NECESSARY TO FINANCE THE FUTURE IMPROVEMENT NEEDS. OTHER ITEMS SUCH AS OPERATION AND MAINTENANCE COSTS, AND THE PRESENT INDEBTEDNESS ARE TABULATED AND GIVEN CONSIDERATION REGARDING FUTURE FINANCING OF CAPITAL IMPROVEMENT ITEMS. (PB-182 779).

00859. CONFERENCE ON THE APPLICATION OF ENGINEERING TECHNOLOGY TO THE PROBLEMS OF APPALACHIA. VOLUME 3. WATER RESOURCES.

WEST VIRGINIA UNIV., MORGANTOWN, COLL OF ENGINEERING, 69 P, 1969.

THE DOCUMENT SURVEYS THE PROBLEMS OF THE APPALACHIA REGION WITH RESPECT TO WATER POLLUTION, WATER USE, AND ECONOMIC FACTORS RELATING TO THE AREA'S WATER SUPPLIES. (PB-183 222).

00860. REGIONAL WATER SUPPLY AND DISTRIBUTION IN THE CENTRAL CONNECTICUT PLANNING REGION.

CENTRAL CONNECTICUT REGIONAL PLANNING AGENCY, PLAINSVILLE, 181 P, 1969.

THIS REPORT ANALYZES EXISTING WATER SUPPLY SYSTEMS IN THIS REGION AND SUGGESTS GUIDELINES AND CRITERIA FOR FUTURE PLANNING TO MEET THE EVER INCREASING NEEDS OF WATER SUPPLY TO THE YEAR 2020. FINDINGS AND RECOMMENDATIONS OF THE REPORT CAN BE OF DIRECT ASSISTANCE TO THE MUNICIPALITIES AND THE REGION FOR EFFICIENT FUTURE PLANNING. (PB-184 184).

00861. SOLAR DISTILLATION UTILIZING MULTIPLE-EFFECT HUMIDIFICATION.

HODGES, C.N.; THOMPSON, T.L.; GROH, J.E.; FRIELING, D.H.
OSW PR-194, 174 P, 1966.

A MULTIPLE EFFECT SOLAR DISTILLATION SYSTEM IS DESCRIBED. A PILOT PLANT WAS CONSTRUCTED AND OPERATED AT PURERTO PENASCO, SONORA, MEXICO. THE PILOT PLANT PRODUCED OVER 3,000 GALLONS PER DAY OF DISTILLED WATER FROM A 10,400 SQUARE FEET OF SOLAR COLLECTOR AREA. A PRELIMINARY ECONOMIC ANALYSIS IS GIVEN WHICH COMPARES PROJECTED COSTS WITH THOSE OF THE SIMPLE SOLAR STILL. (PB-206 086).

REFERENCE LIST

00862. COMPREHENSIVE SEWERAGE PLAN. PART I. DATA SUMMARY: PUBLIC SEWERAGE SYSTEMS.

SMITH, D.B.; SCOTT, D.H.
PALM BEACH COUNTY AREA PLANNING BOARD. WEST PALM BEACH. FLA. 57 P, 1968.

EXPENDITURE OF NEARLY $3,000,000 ANNUALLY RANKS PALM BEACH COUNTY FIFTH OUT OF 67 FLORIDA COUNTIES IN TOTAL CONSTRUCTION OF PUBLIC SEWERAGE FACILITIES. PUBLIC SEWERAGE FACILITIES INCLUDE 115 SEPARATE SYSTEMS IN PALM BEACH COUNTY, 34 OF WHICH ARE CONSIDERED EXPANDABLE. SEPTIC TANK OR OTHER PRIVATE SYSTEMS SERVE NEARLY 20% OF THE COUNTY POPULATION. DELRAY BEACH, LAKE WORTH, PALM BEACH, AND SOON BOCA RATON DISCHARGE SEWAGE INTO THE ATLANTIC OCEAN THOUGH OCEAN OUTFALLS WHICH EXTEND TO THE EDGE OF THE GULF STREAM. APPROXIMATELY 10.5 MILLION GALLONS OF SEWERAGE SYSTEM EFFLUENT DISCHARGES EACH DAY INTO THE COUNTY'S FRESH WATER RESOURCE. THIRTEEN SEWERAGE SYSTEMS DISCHARGE EFFLUENT INTO LAKE WORTH OR THE INTRACOASTAL WATERWAY. CLUSTERS OF SMALL, PRIVATELY OWNED SEWERAGE SYSTEMS AND SEPTIC TANK AREAS INDICATE THE NEED FOR ADDITIONAL PUBLIC SEWER CONSTRUCTION. MUNICIPAL AND PRIVATE UTILITY COMPANIES OPERATE THE PUBLIC SEWERAGE SYSTEMS. THE FLORIDA PUBLIC SERVICE COMMISSION AND/OR THE PALM BEACH COUNTY BOARD OF COUNTY COMMISSIONERS GRANT AND CONTROL FRANCHISES OF THE 25 PRIVATE SEWERAGE UTILITY COMPANIES IN THE COUNTY. (PB-184 677).

00863. COST OF PUMPING WATER.

ILLINOIS STATE WATER SURVEY, TECHNICAL LETTER- 9, 4 P, 1968.

THE INFORMATION ON THE COST OF PUMPING WATER REPRESENTS ONE PRODUCT OF RESEARCH CURRENTLY UNDER WAY AT THE ILLINOIS STATE WATER SURVEY ON THE COST OF WATER RESOURCE DEVELOPMENT. USE OF THIS MATERIAL WILL ASSIST IN THE DETERMINATION OF COST OF PUMPING WATER, GIVEN THE QUANTITY OF FLOW REQUIRED, THE TOTAL PUMPING HEAD, THE WIRE TO WATER EFFICIENCY, AND THE UNIT COST OF POWER. A TABLE OF CONVERSIONS IS PRESENTED TO AID IN REDUCING THEORETICAL EQUATIONS TO SIMPLIFIED EQUATIONS, AND A FIGURE IS PROVIDED FOR GRAPHICAL SOLUTIONS OF THE EQUATIONS. (PB-185 858).

00864. COSTS OF WELLS AND PUMPS.

ILLINOIS STATE WATER SURVEY, TECHNICAL LETTER-10, 9 P, JUL 1968.

THE LETTER CONCERNING THE COST OF WELLS AND PUMPS REPRESENTS ONE PRODUCT OF RESEARCH CURRENTLY UNDER WAY AT THE ILLINOIS STATE WATER SURVEY ON THE COST OF WATER RESOURCES DEVELOPMENT. THE USE OF THIS MATERIAL WILL GIVE AN ESTIMATE OF THE WELL AND PUMP COSTS FOR PROJECTS REQUIRING A GIVEN CAPACITY. THIS IS INTENDED ONLY AS AN INSTRUMENT FOR ESTABLISHING ORDERS OF MAGNITUDE AS A BASIS FOR COMPARISONS, AND OF COURSE DOES NOT SUBSTITUTE FOR DETAILED ENGINEERING STUDIES. (PB-185 857).

00865. POLYMERS FOR SEWER FLOW CONTROL.

WESTERN CO. OF NORTH AMERICA, RICHARDSON, TEX, WP-20-22 289 P, 1969.

SIX WATER-SOLUBLE POLYMERS WERE INVESTIGATED TO DETERMINE THEIR EFFECTS UPON AQUATIC FLORA AND FAUNA, FLOW CHARACTERISTICS OF WATEWATER, AND THE OPERATION OF A WASTEWATER TREATMENT PLANT. IT WAS FOUND THAT THE POLYMERS AND GELS, IN THE MAGNITUDES TESTED, WERE NOT TOXIC TO BACTERIA, ALGAE, OR FISH, AND DID NOT ACT AS A NUTRIENT FOR ALGAE GROWTH, BASED UPON CALCULATIONS OBTAINED FROM FLOW TEST DATA. (PB-185 681) (W69-10256).

00866. MILWAUKEE STUDY AREA.

AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK, 99 P, DEC.1968.

THIS REPORT IS PART OF AN OVERALL RESEARCH STUDY BEING CONDUCTED BY THE AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE) TO DETERMINE THE FEASIBILITY OF SEPARATING COMBINED SEWERAGE BY USING A SYSTEM OF PRESSURE CONDUITS TO CONVEY SANITARY SEWAGE FROM INDIVIDUAL STRUCTURES TO AN EXISTING INTERCEPTOR. A COST ESTIMATE OF TWO ALTERNATIVE PRESSURE SEWER LAYOUTS HAS BEEN MADE AND COMPARED TO THE COST OF ACCOMPLISHING IN-HOUSE SEPARATION AND AREA COLLECTION OF WASTES BY THE CONVENTIONAL GRAVITY SEWER SYSTEM. (PB-186 003).

00867. NON-MECHANICAL CONSIDERATIONS INVOLVED IN IMPLEMENTING PRESSURIZED SEWERAGE SYSTEMS.

WALKER, D.H.
AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK, TM-12, 30 P, MAY 196, .

THE GENERAL CONCEPT INVOLVES THE DISCHARGE OF COMMINUTED OR GROUND SEWAGE FROM BUILDINGS AND/OR BUILDING COMPLEXES, VIA RELATIVELY SMALL PRESSURE TUBING, INTO NEW PRESSURE SANITARY SEWERS. THE NEW PRESSURE SANITARY SEWERS WOULD DISCHARGE INTO EXISTING INTERCEPTORS THAT WOULD CONVEY THE SANITARY SEWAGE TO TREATMENT WORKS; STORM WATER WOULD BE CONVEYED IN WHAT WERE FORMERLY COMBINED SEWERS. THE BASIC OBJECTIVES OF THE STUDY WERE TO DETERMINE THE PHYSICAL FEASIBILITY AND LIMITATIONS OF THE SYSTEM AND TO ARRIVE AT MEASURES OF COST FOR COMPARISON WITH THE TRADITIONAL METHOD OF SEPARATION FOR EVALUATION OF INVESTMENT FEASIBILITY. (PB-186 008).

00868. HYDRAULICS OF A PRESSURIZED SEWERAGE SYSTEM AND USE OF CENTRIFUGAL PUMPS.

TUCKER, L.S.
AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK, TM-6, 41 P, NOV 1967.

THE ASCE COMBINED SEWER SEPARATION PROJECT IS SUPPORTED BY CONTRACT NO. 14-12-29 WITH THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. TASK 4 OF THAT CONTRACT RELATES TO FEASIBILITY STUDIES OF HYPOTHETICAL PRESSURE SEWERAGE SYSTEMS. THIS TECHNICAL MEMORANDUM IS ONE OF THE REFERENCE BACKGROUND INPUTS FOR THE THREE SYSTEM STUDIES UNDER TASK 4, COVERING THE GENERAL HYDRAULIC REQUIREMENTS FOR BOTH STREET SEWERS AND PUMPING FROM LARGER BUILDINGS. (PB-186 012).

00869. AN INVESTIGATION OF LIGHT CATALYZED CHLORINE OXIDATION FOR TREATMENT OF WASTEWATER.

MEINERS, A.F.; LAWLER, E.A.; WHITEHEAD, M.; MORRISON, J.J.
TWRC-3, TWRC-AWTRL-3, 128 P, DEC 1968.

A STUDY WAS MADE OF THE EFFECT OF ULTRAVIOLET RADIATION ON THE RATE AND EXTENT OF CHLORINE OXIDATION OF ORGANIC MATERIAL IN HIGHLY NITRIFIED EFFLUENTS FROM BIOLOGICAL SEWAGE TREATMENT PLANTS. ULTRAVIOLET RADIATION WILL VERY SIGNIFICANTLY INCREASE THE RATE OF THIS REACTION. ALSO, THE EXTENT OF OXIDATION WHICH CAN BE ACHIEVED BY CHLORINE COMBINED WITH UV RADIATION IS USUALLY MUCH GREATER THAN THAT WHICH CAN BE ACHIEVED BY CHLORINE ALONE. (PB-187 757).

00870. USE OF GRANULAR REGENERABLE CARBON FOR TREATMENT OF SECONDARY EFFLUENT. ENGINEERING DESIGN AND ECONOMIC EVALUATION.

ALLEN, J.B.; CLAPHAM, T.M.; JOYCE, R.S.; SUKENIK, V.A.
PITTSBURGH ACTIVATED CARBON CO., 66 P, 1964.

INDICATIVE CAPITAL AND OPERATING COST ESTIMATES HAVE BEEN PREPARED FOR PLANTS TO TREAT EFFLUENT FROM ACTIVATED SLUDGE PLANTS WITH GRANULAR REGENERABLE ACTIVATED CARBON. THE CAPITAL COST ESTIMATES ARE BASED ON PLANTS IN TYPICAL LOCATIONS, WITH ALLOWANCES FOR SITE DEVELOPMENT, PROVISIONS FOR SERVICES, ENGINEERING DESIGN, CONTRACTORS' PROFIT AND IN ACCORDANCE WITH THE GENERAL QUALITY OF CONSTRUCTION OF MUNICIPAL SEWAGE WORKS. (PB-187 723).

00871. PUBLIC SERVICE AND FACILITIES ELEMENT: SEWAGE DISPOSAL, THE CITY OF ANDERSON GENERAL PLAN.

HAHN, WISE AND ASSOCIATES, INC., SAN CARLOS, CALIF. 24 P, JAN 1970.

THE REPORT COVERS THE FOLLOWING: A REVIEW OF EXISTING REPORTS AND RECORDS RELATED TO THE CITY'S SEWERAGE SYSTEM, STUDY OF ENVIRONMENTAL CONDITIONS AND THEIR INFLUENCE IN RELATION TO PRESENT AND PROSPECTIVE USES OF SEWERAGE FACILITIES; AN ANALYSIS OF THE EXISTING SEWERAGE FACILITIES TO INCLUDE LOCATION OF TRUNK SEWERS AND LIFT STATIONS, THE PREPARATION OF MAPS, CHARTS, DIAGRAMS, AND DRAWINGS SHOWING THE ESSENTIAL FEATURES OF THE RECOMMENDED IMPROVEMENTS, AND THE PREPARATION OF COST ESTIMATES FOR THE RECOMMENDED IMPROVEMENTS. (PB-189 869)

00872. ECONOMIC ASPECTS OF OCEAN ACTIVITIES. VOLUME III. ECONOMIC ASPECTS OF SOLID WASTE DISPOSAL AT SEA.

MASSACHUSETTS INST. OF TECH., MSC-71-68, 134 P, SEPT 1970.

THE REPORT CONCENTRATES ON THE ECONOMICS (IN A SENSE WIDE ENOUGH TO INCLUDE ALL COSTS AND BENEFITS) ASSOCIATED WITH THE DISPOSAL OF THE SOLIDS NORMALLY FOUND IN THE REFUSE COLLECTED BY LARGE COASTAL CITIES. IT COMPARES THE MARKET COSTS OF VARIOUS DISPOSAL ALTERNATIVES AND DERIVES, THROUGH PRESENT VALUE ANALYSIS, UNIT MARKET DISPOSAL COSTS FOR SANITARY LAND FILL VIA RAIL HAUL, INCINERATION ON LAND, DUMPING OF COMPACTED BALES AT SEA, AND INCINERATION AT SEA, POINTING OUT THE POTENTIAL ECOLOGICAL PROBLEMS INHERENT IN EACH SYSTEM, AND THE RELEVANT AVAILABLE INFORMATION.

00873. A METHOD FOR THE EVALUATION OF THE SYSTEM AND COST EFFECTIVENESS OF LARGE SEA WATER DISTILLATION PLANTS.

BROWN, A.
OSW-PR-539, 106 P, MAR 1970.

THE REPORT DISCUSSES THE APPROACH USED IN DEVELOPING THE PLANT EFFECTIVENESS MODEL AND IN APPLYING COST/EFFECTIVENESS ANALYSES. THE RESULTS OF APPLYING THE COST EFFECTIVENESS ANALYSIS TO BOTH THE MULTISTAGE FLASH (MSF) TYPE AND THE COMBINED VERTICAL-TUBE-FLASH EVAPORATOR (VTE) TYPE DESALTING PLANTS ARE GIVEN. EIGHTEEN VARIATIONS OF THESE WERE FOUND TO BE COST-EFFECTIVE AND THE INVESTMENT THRESHOLD WAS FOUND FOR FOUR OTHER VARIATIONS AS A MEANS FOR DEMONSTRATING THE VALIDITY AND USEFULNESS OF THE METHODOLOGY DEVELOPED. (PB-201 023).

00874. PARAMETRIC STUDY OF A ONE MGD BRACKISH WATER REVERSE OSMOSIS PLANT (SPIRAL MODULE CONCEPT).

MENZEL, H.F.
OSW-PR-236, 85, 1967.

THE REPORT DESCRIBES THE RESULTS OF A PARAMETRIC ECONOMIC STUDY ON A ONE MILLION GALLON PER DAY SPIRAL WOUND REVERSE OSMOSIS PLANT DESALTING BRACKISH WATER. THE COSTS OF WATER RECOVERY ARE DISCUSSED. (PB-206 069).

00875. WASTEWATER TREATMENT TECHNOLOGY.

PATTERSON, J.W.; MINEAR, R.A.
HEQ-71-4, 271 P, AUG 1971.

THE DOCUMENT IS A STATE OF THE ART SURVEY OF INDUSTRIAL WASTE TREATMENT LITERATURE PERTAINING TO 22 MATERIALS FREQUENTLY FOUND IN INDUSTRIAL WASTES: ARSENIC, BARIUM, BORON, CADMIUM, HEXAVALENT AND TRIVALENT CHROMIUM, COPPER, CYANIDE, FLUORIDES, SOLUBLE AND TOTAL IRON, LEAD, MANGANESE, NICKEL, OILY WASTES, PH CONTROL, PHENOLS, SELENIUM, SILVER, TOTAL DISSOLVED SOLIDS, CHLORIDE, AND ZINC. INFORMATION ON EXISTING METHODS OF TREATMENT, LEVELS OF TREATMENT ATTAINABLE, AND ASSOCIATED COSTS IS PRESENTED. IDENTIFICATION OF THE IMPACT WHICH SPECIFIC TREATMENT PROCESSES MIGHT HAVE UPON EFFLUENT DISCHARGE LEVELS HAS BEEN ATTEMPTED. (PB-204-521).

00876. ECONOMIC INFORMATION FOR ENVIRONMENTAL QUALITY MANAGEMENT.

PAIK, I.K.
UMTA-URT-37-(70) 71-5, 20 P, JUN 1971.

THE PURPOSE OF THE PAPER IS TO ESTABLISH AN INITIAL OVERVIEW OF THE NEEDS FOR AN INTELLIGENT DEBATE ON THE PROBLEM OF ENVIRONMENTAL QUALITY MANAGEMENT. POSSIBLE EFFECTS OF ENVIRONMENYAL CONTROL ON THE AGGREGATE ECONOMY ARE DISCUSSED, AND ALTERNATIVE TECHNIQUES ARE SUGGESTED THAT CAN BE APPLIED TO ASSESS THEM. THE GENERAL FRAMEWORK INTENDED TO HELP IN MEASURING COSTS AND BENEFITS OF POLLUTION CONTROL ARE PRESENTED. FINALLY THE NEED FOR EVALUATING AND

ANALYZING LEVELS OF DISAGGREGATION AND MANAGEMENT UNIT IS INVESTIGATED. (PB-203 284).

00877. PROPOSED DUAL PURPOSE NUCLEAR DESALTING PLANT USING SINGLE EFFECT DISTILLATION.

JONES, J.E. JR.; ANDERSON, T.D.
SYMPOSIUM ON WATER REUSE, AICHE, 63(78), 1967.

A NOVEL AND CONCEPTUALLY SIMPLE DUAL PURPOSE NUCLEAR DESALTING PLANT IS PROPOSED. THE EVAPORATOR IS PLACED BETWEEN THE TURBINE EXHAUST AND THE CONDENSER OF A CONVENTIONAL NUCLEAR POWER PLANT. IT IS ESTIMATED THAT THE WATER PRODUCTION COST FOR THE PROPOSED PLANT WOULD BE 38% LESS THAN FOR THE BEST ALTERNATIVE DUAL PURPOSE PLANT USING A HIGH TEMPERATURE MULTIEFFECT EVAPORATOR. THE COST SAVINGS RESULT FROM LOWER HEAT COST, ELIMINATION OF FEED-WATER TREATMENT, REDUCED PUMPING POWER, AND THE USE OF ALUMINUM TUBES AND A CONCRETE SHELL IN THE LOW-TEMPERATURE EVAPORATOR. (ORNL-TM-2964).

00878. RECOVERY AND UTILIZATION OF MUNICIPAL SOLID WASTE.

DROBNY, N.L.; HULL, H.E.; TESTIN, R.F.
EPA SW-10C-71, 66 P, 1971.

THE REPORT COMPILES AVAILABLE COST AND PERFORMANCE CHARACTERISTICS OF PROCESSES THAT ARE, OR MIGHT BE, EMPLOYED IN SOLID WASTE RECOVERY AND UTILIZATION. THE INFORMATION WAS OBTAINED FROM OPERATORS OF EXISTING SYSTEMS, EQUIPMENT MANUFACTURERS, AND SELECTED EXPERTS AND THE STUDY IS FOCUSED ON SIZE REDUCTION, SEPARATION, AND RECOVERY AND UTILIZATION. THE DEGREE TO WHICH THE SEPARATION TECHNIQUES STUDIED CAN BE ADOPTED IN PRACTICE IS NOT WELL ESTABLISHED BECAUSE OF THE LACK OF SUITABLE COST AND PERFORMANCE DATA UPON WHICH TO BASE EVALUATIONS; IN THE AREA OF RECOVERY AND UTILIZATION OF MIXED SOLID WASTE, BYPRODUCT RECOVERY APPEARS TO HAVE GREATER ECONOMIC POTENTIAL THAN DOES MATERIAL SALVAGE. (PB-204 922).

00879. SOLVENTLESS EXTRUDED POWDER N-5 GENERAL WATER POLLUTION STUDY (DENITRIFICATION).

GILKISON, T.M.
SUN-143-10, 71 P. 1971.

THE BIOLOGICAL DENITRIFICATION PROCESS WAS STUDIED TO DETERMINE ITS EFFECTIVENESS IN REMOVING NITRATES FROM SUNFLOWER ARMY AMMUNITION PLANT (SAAP) WASTEWATER. LABORATORY AND PILOT PLANT STUDIES WERE CONDUCTED ON BOTH BATCH AND CONTINUOUS OPERATIONS. SEWAGE AND SLUDGE FROM IMHOFF SETTLING TANKS WERE USED AS SOURCES OF BACTERIA TO TREAT NEUTRALIZED WASTEWATERS THAT WERE HIGH IN NITRATES, RANGING FROM 100 TO 230 MG/L OF NITRATE NITROGEN. NITRATE REMOVAL RANGED FROM 70% AT LOW TEMPERATURES TO AS HIGH AS 99% AT HIGH TEMPERATURES. BACTERIAL DENITRIFICATION WAS FOUND TO BE A FEASIBLE AND PRACTICAL METHOD TO REDUCE THE CONCENTRATION OF NITRATES TO SAAP WASTEWATER. (AD-724 866).

00880. STUDY OF EQUIPMENT AND METHODS FOR REMOVING OR DISPERSING OIL FROM OPEN WATERS.

HENAGER, C.H.; WALKUP, P.C.; BLACKLAW, J.R.; SMITH, J.D.; POLENTZ, L.M.
BATTELLE MEMORIAL INSTITUTE, RICHLAND, WASHINGTON. NCEL-CR-71.001, 247 P, 1970.

A COST EFFECTIVENESS ANALYSIS WAS PERFORMED FOR EQUIPMENT MATERIALS AND TECHNIQUES APPLICABLE TO THE REMOVAL OR DISPERSAL OF SPILLED OIL FROM U. S. NAVY AO AND AOG VESSELS ON OPEN WATERS. CRITERIA FOR EVALUATION OF SYSTEMS FORMULATED FOR PRESENTLY AVAILABLE EQUIPMENT AND MATERIALS INCLUDE: COMPLETENESS OF OIL REMOVL; [illegible]TE OF REMOVAL; HAZARD AND POLLUTION; USE IN LIMITED ACCESS AREAS; SENSITIVITY TO EXPECTED ENVIRONMENTAL FACTORS; SENSITIVITY TO TEMPERATURE EXTREMES; TOXICITY TO MARINE LIFE AND SYSTEM AVAILABILITY. (AD-716 792).

00881. EFFECTS OF POLLUTION CONTROL ON THE FIRM.

TIHANSKY, D.P.
RAND CORP, SANTA MONICA, CALIF. REPT NO. P-4725, 14 P, 1971.

THE REPORT DISCUSSED THE EFFECTS OF POLLUTION CONTROL ON AN INDUSTRIAL FIRM. ALTHOUGH LEGAL CONSTRAINTS MAY NOW NECESSITATE A FIRM TO CONTROL ANY POLLUTION IT GENERATES, THE AUTHOR POINTS OUT THAT POLLUTION CONTROL EVEN IF NOT LEGALLY REQUIRED CAN PROVE TO BE BENEFICIAL. THE MONETARY EFFECTS, COSTS, AND BENEFITS ARE DISCUSSED. (AD-737-681).

00882. AN EVALUATION OF SELECTED POLYELECTROLYTES AS FILTER BED CONDITIONERS IN WATER TREATMENT.

OLESEN, D.E.; SCHMIDT, R.L.; TOUHILL, C.J.
BATTELLE-NORTHWEST LAB. 35 P. MAY 1968.

THIS RESEARCH HAS SHOWN FIVE POLYELECTROLYTES TO BE AS EFFECTIVE AS THOSE PRESENTLY USED AS FILTER BED CONDITIONERS AT THE HANFORD WATER TREATMENT PLANTS. COST COMPARISONS ARE PRESENTED FOR THE POLYELECTROLYTES STUDIED. LABORATORY FILTRATION DATA IS INCLUDED FOR TWENTY-TWO POLYELECTROLYTES. (BNWL-734).

00883. STUDY OF EQUIPMENT AND METHODS FOR REMOVING OIL FROM HARBOR WATERS.

WALKUP, P.C.; POLENTZ, L.M.; SMITH, J.D.; PETERSON, P.L.
BATTELLE MEMORIAL NORTHWEST LABS, CR-70.001, 189 P. AUG 1969.

A COST EFFECTIVENESS ANALYSIS WAS PERFORMED FOR EQUIPMENT, MATERIALS AND TECHNIQUES FOR THE REMOVAL OF SPILLED PETROLEUM PRODUCTS FROM THE SURFACE AND HARBOR WATERS USED BY U. S. NAVAL CRAFT. EFFECTIVENESS CRITERIA, FORMULATED FOR PRESENT METHODS AND PRESENTLY AVAILABLE EQUIPMENT AND MATERIALS, INCLUDED SPEED OF APPLICATION, COMPLETENESS OF REMOVAL, EASE OF OPERATION, EFFECT ON MARINE LIFE, OPERATING CNTINUITY, AND AVAILABILITY. PARAMETERS FOR THE EFFECTIVNESS STUDY WERE BASED ON THE PETROLEUM PRODUCTS NOW IN USE OR THOSE PLANNED FOR FUTURE USE AND A

DETAILED REVIEW OF THE GEOGRAPHIC, HYDROGRAPHIC, PHYSICAL, AND ENVIRONMENTAL CHARACTERISTICS OF PORTS USED BY THE U. S. NAVY. THE TWO MOST COST-EFFECTIVE SYSTEMS FOR BROAD APPLICATION WERE FOUND TO BE MECHANICAL RECOVERY OF SPILLED MATERIAL BY SURFACE SUCTION DEVICES, SUPPLEMENTED BY MECHANICAL CONTAINMENT, AND THE APPLICATION OF CHEMICAL DISPERSANTS BY PIER- OR VESSEL-MOUNTED HIGH PRESSURE SPRAY EQUIPMENT. (AD-696 980).

00884. EXPERIMENTAL INVESTIGATION OF DIRECT FREEZE SEPARATION PROCESS USING REFRIGERANT R-C318 (OCTAFLUOROCYCLOBUTANE).

JOHNSON, C.A.; MOORE, S.J.; WAGAMAN, N.D.; SANDELL, D.J.
OSW-PR-256, 134 P, 1967.

A LABORATORY STUDY WAS MADE TO DETERMINE THE SIZE OF ICY CRYSTALS WHICH CAN BE MADE BY DIRECT CONTACT OF SALINE WATER WITH THE REFRIGERANT R-C318, OCTAFLUOROCYLOBUTANE. THE USE OF R-C318 AS A SECONDARY REFRIGERANT IN A FREEZING PROCESS FOR DESALTING WAS DEMONSTRATED AND A 37,000 GPD PILOT PLANT WAS DESIGNED. A MULTISTAGE FLASH PRECOOLER WAS OPERATED. BENCH-SCALE TESTS DEMONSTRATE WATER HIGH IN CALCIUM SULFATE (ROSWELL, NEW MEXICO, WATER). THE FREEZING PROCESS OPERATED WITHOUT PRECIPITATION OF HARDNESS SALTS ON HEAT TRANSFER SURFACES. (PB-206 070).

00885. ANALYSIS OF COMPREHENSIVE WATER SUPPLY AND SEWERAGE DISPOSAL STUDIES.

ULSTER COUNTY PLANNING BOARD, KINGSTON, N.Y., 23 P, JUNE 1971.

THE REPORT REVIEWS THE ALTERNATIVES AND POLICY IMPLICATIONS PRESENTED BY ENGINEERING CONSULTANTS IN THE COMPREHENSIVE WATER SUPPLY AND SEWERAGE DISPOSAL PLANS FOR ULSTER COUNTY FOR THE YEAR 2020. RECOMMENDATIONS ARE MADE ON NEW LEGISLATION AND FUNDING NEEDED TO IMPLEMENT THESE STUDIES. (PB-200 816).

00886. THE ECONOMICS OF A REGIONAL MUNICIPAL DESALTING SYSTEM IN THE LOWER RIO GRANDE VALLEY OF TEXAS.

HUNTER, J.A.; STROBEL, J.J.; MILLER, E.F.
OSW-PR-273, 148 P, 1967.

THE REPORT PRESENTS THE RESULTS OF THE STUDY OF THE APPLICATION OF A LARGE-SCALE DESALTING SYSTEM TO SERVE AN INTERMUNICIPAL AREA IN THE LOWER RIO GRANDE VALLEY IN TEXAS. TOPICS INCLUDE: CURRENT WATER AVAILABILITY AND WATER QUALITY IN THE LOWER RIO GRANDE VALLEY; THE PRELIMINARY TEXAS WATER PLAN AND HOW IT WILL AFFECT THE LOWER RIO GRANDE VALLEY; PROJECTED MUNICIPAL WATER DEMAND IN THE LOWER RIO GRANDE VALLEY TO THE YEAR 2000; MEETING THE PRESENT AND FUTURE MUNICIPAL WATER REQUIREMENTS IN THE VALLEY WITH DESALTED WATER; TYPES AND COMBINATIONS OF DESALTING PLANTS AND DISTRIBUTION SYSTEMS STUDIED; REDUCTION OF PRODUCT WATER UNIT COSTS THROUGH FEEDWATER PREHEATING IN ELECTRODIALYSIS; WATER DISTRIBUTION ARRANGEMENTS AND COST DATA IN THE LOWER RIO GRANDE VALLEY; SUMMARY OF UNIT COSTS AND CAPITAL COSTS FOR THE FIVE SELECTED CASES; SPECIFIC ADVANTAGES OF THE VARIOUS CASES STUDIES; DESALTING AS AN INTERIUM SOLUTION. (PB-178 524).

00887. NEW MINE SEALING TECHNIQUES FOR WATER POLLUTION ABATEMENT.

FWPCA-14010-DMO, 177 P, MAR 1970.

TWO NEW PROCESSES WERE DEVELOPED. ONE INVOLVED TECHNIQUE OF PLACING A PLUG OR GRADED LIMESTONE AGGREGATE IN A MINE DRIFT OR PROTAL TO NEUTRALIZE AN ACID MINE WATER DISCHARGE UNTIL A SEAL WAS EFFECTED. THE SECOND PROCESS CONSISTED OF REMOTELY CONSTRUCTING A MINE SEAL INCLUDING REAR AND FRONT BULKHEADS OF A SELF-SUPPORTING, QUICK-SETTING SODIUM SILICATE CEMENT SPECIFICALLY DEVELOPED FOR THIS APPLICATION. (PB-196 735).

00888. MANUAL ON SOLAR DISTILLATION OF SALINE WATER.

TALBERT, S.G.; EIBLING, J.A.; LOF, G.O.G.
OSW-PR-546, 275 P, 1970.

THE MANUAL IS A COMPREHENSIVE TREATISE ON THE STATE OF THE ART OF SOLAR DISTILLATION FOR APPRAISING WATER SUPPLY POTENTIAL OF SOLAR STILLS AND ASSISTING IN THE DESIGN OF PRACTICAL PLANTS. THE MANUAL INCLUDES A HISTORICAL REVIEW, SOLAR STILL TECHNOLOGY, DATA OF MEANINGFUL VALUE FROM BASIN-TYPE SOLAR STILLS THAT HAVE BEEN OPERATED FOR EXTENDED PERIODS, ECONOMICS, OVERALL APPRAISAL OF SOLAR DISTILLATION, AND PROCEDURES FOR SIZING AND BUILDING SOLAR STILLS. CAPITAL COSTS OF LARGE STILLS HAVING AREAS LARGER THAN 1000 FT SQUARED IS SHOWN TO BE AS LOW AS $1.00/SQ FT OF BASIN AREA WITH WATER COSTS BETWEEN $3-$4.00 PER 1000 GALS. THE COSTS FOR SMALL FAMILY SIZE UNITS ARE NEAR $4.00/SQ FT OF BASIN AREA WITH WATER COSTS BETWEEN $3-$4.00 PER 1000 GALS. THE COSTS FOR SMALL FAMILY SIZE UNITS ARE NEAR $4.00/SQ FT OF BASIN AREA AND WATER COSTS RANGE FROM $15 TO $30/1000 GALLONS. LONG TERM TESTS OF BETTER MATERIALS ARE RECOMMENDED IF COSTS ARE TO BE LOWERED.

00889. CONCEPTUAL DESIGNS OF OUTFALL SYSTEMS FOR DESALTING PLANTS.

ZEITOUN, M.A.; MCILLHENNY, W.F.; REID, R.O.; WONG, C.M.; SAVAGE, W.F.
OSW-PR-550, 151 P, 1970.

DESIGN CONCEPTS OF OUTFALL SYSTEMS FROM COASTAL DESALTING PLANTS WERE DEVELOPED BASED ON BOTH EXPERIMENTAL AND THEORETICAL ANALYSES OF THE DISPERSION OF DENSE JETS OF VARIOUS CONFIGURATIONS. A COMPUTER PROGRAM WAS DEVELOPED TO ALLOW CALCULATION OF THE DIFFERENT EFFLUENT CONCENTRATION FACTORS AND PERFORMANCE RATIOS FOR GIVEN AMBIENT CONDITIONS. FOR EACH DESIGN CASE, THE REQUIRED DILUTION OF COPPER CONCENTRATION IN THE MIXED EFFLUENT TO A VALUE OF 0.02 MILLIGRAMS PER LITER WAS CALCULATED AND USED AS THE CRITERION FOR THE DESIGN OF THE DIFFUSER. DIFFUSER DESIGN CHARTS WERE DEVELOPED FOR 2, 5, 10 AND 50 MILLION GPD PLANTS. CONCEPTUAL DESIGNS AND COST ESTIMATES WERE MADE FOR THE ABOVE FOUR SIZES OF PLANTS. (PB-201 033).

REFERENCE LIST

00890. STUDY OF SEAWATER DESALTING AS EMERGENCY WATER SUPPLY FOR NEW YORK CITY.

SCHEFFER, S.L.; TERENZIO, V.J.; SENATORE, S.J.; MILLER, E.F.
OSW-PR-553, 310 P, 1970.

THE REPORT CONCERNS AN INVESTIGATION OF THE PRELIMINARY FEASIBILITY AND COST OF SUPPLYING 20 PERCENT OF THE NOMINAL WATER DEMAND OF A TYPICAL BOROUGH OF THE CITY OF NEW YORK DURING PERIODS OF PROLONGED DROUGHT OF THE KIND EXPERIENCED IN THE MID SIXTIES. MULTISTAGE FLASH DESALTING MODULES OF 5, 10 AND 25 MGD CAPACITIES WERE ASSUMED FOR APPLICATION IN MODULAR ARRAY TO PROVIDE EMERGENCY BOROUGH NEEDS FOR PURE WATER UP TO 125 MGD IN CAPACITY FOR A SINGLE PLANT SITE. THE SPECIFIC PLANT STUDIED WAS ASSUMED TO BE LOCATED ON AN ARTIFICIAL ISLAND CONSTRUCTED ONE MILE OFF ROCKAWAY BEACH. EXTENSIVE COST DATA ARE PROVIDED. (PB-201 036).

00891. PROJECTED WASTEWATER TREATMENT COSTS IN THE ORGANIC CHEMICAL INDUSTRY.

WATER POLLUTION CONTROL RESEARCH SERIES, EPA-12020-GND-07/71, 166 P, 1871.

THE REPORT PRESENTS A DESCRIPTION OF THE ORGANIC CHEMICAL INDUSTRY AND THE COSTS THE INDUSTRY WOULD INCUR IN ATTAINING VARIOUS LEVELS OF POLLUTION ABATEMENT OVER THE FIVE YEAR PERIOD THROUGH 1974. THE REPORT PRESENTS IN CONSIDERABLE DETAIL THE DESCRIPTION OF THE VARIOUS PRODUCTION PROCESSES, THE WASTE TREATMENT METHODS PRACTICED, AND THE POSSIBLE IMPACT THAT CHANGES IN PROCESSES MIGHT HAVE ON THE VOLUME AND CHARACTER OF THE WASTES PRODUCED. (PB-206 429).

00892. OPTIMUM BRINE HEATER OUTLET TEMPERATURE IN SEA WATER CONVERSION EVAPORATORS.

DILUZIO, F.C.; GILLAM, W.S.; SOLOMON, J.H.; COLEY, F.H.
OSW-PR-175, 107 P, 1966.

LARGE SIZE NUCLEAR POWER AND WATER DESALITNG PLANTS MAY ANSWER THE FUTURE NEEDS OF AN EXPANDING CIVILIZATION FOR POWER AND WATER, BUT THE MORE IMMEDIATE PROBLEM OF PROVIDING INCREMENTAL WATER SUPPLIES UP TO 50 MGD WHERE NO POWER IS NEEDED IS UNANSWERED. A SINGLE PURPOSE FOSSIL FUELED DESALINATION PLANT WITH A CAPACITY FROM 8 TO 50 MGD HAS BEEN DEVELOPED. A MODIFICATION OF THIS PLANT WITH ACID PRETREATMENT AND OPERATING AT 290 DEG F MAXIMUM BRINE TEMPERATURE WILL PRODUCE 50 MGD OF WATER AT A REASONABLE COST. TOTAL WATER COSTS HAVE BEEN DEVELOPED FOR BRINE HEATER OUTLET TEMPERATURES FROM 250 DEG F TO 400 DEG F. FOR FUEL COSTS OF 20, 30 AND 40 CENTS/MBTU. FROM THESE, COSTS AFFORDABLE FOR SCALE PREVENTION AT THE DIFFERENT TEMPERATURES AND FUEL COSTS HAVE BEEN DETERMINED. (PB-206 489).

00893. A MANUAL ON WATER DESALINATION. VOLUME II. ECONOMICS.

TA/OST-AN-67-4-2, 179 P, 1967.

THE REPORT PROVIDES GUIDELINES FOR THE INITIATION OF A PROGRAM FOR DEFINING AND SOLVING THE WATER SHORTAGE PROBLEMS OF A PARTICULAR NATION OR REGION USING DESALINATION. ITS SCOPE INCLUDES THE FORMULATION OF A LOGICAL AND FEASIBLE WATER DEVELOPMENT PLAN; THE ACCOMPLISHMENT OF PRELIMINARY FEASIBILITY STUDIES ON THE POSSIBLE SOLUTIONS, AND THE DETERMINATION OF THE MOST PROMISING COURSE OF ACTION BASED UPON THE RESULTS OF THESE STUDIES; AND THE ACCOMPLISHMENT OF A DETAILED ENGINEERING FEASIBILITY AND ECONOMIC STUDY OF THE POSSIBLE ALTERNATIVES. A SERIES OF ESTIMATING AIDS AND NOMOGRAPHS FOR DETERMINING CAPITAL COSTS OF DESALINATION PLANT FACILITIES IS INCLUDED (PB-206 550).

00894. STUDY OF ELECTRICAL ANALOGUE FOR ELECTRODIALYSIS.

BERGER, C.; GUTER, G.A.; BELFORT, G.
OSW-PR-238, 163 P, 1967.

THE OBJECTIVES OF THE STUDY WERE TO FORMULATE A GENERAL MATHEMATICAL EQUATION FOR ELECTRODIALYSIS BASED ON CONSIDERING THE PROCESS AS AN ELECTRICAL NETWORK COMPOSED OF RESISTIVE ELEMENTS REPRESENTATIVE OF VARIOUS ELECTROCHEMICAL PROCESSES AND TO APPLY THE EQUATION TO SPECIFIC SITUATIONS AND DETERMINE HOW VARIATIONS IN OPERATING PARAMETERS AND OTHER VARIABLES INFLUENCE PERFORMANCE AND OPERATING COSTS. WHEN THE EQUATION WAS APPLIED, THE MAJOR RESISTIVE FACTORS WERE ELECTROLYTE RESISTANCE, OHMIC POLARIZATION (DUE PRIMARILY TO SCALE) AND MEMBRANE POTENTIALS. THE MINOR RESISTIVE ELEMENTS WERE ELECTRODE POLARIZATION, MEMBRANE RESISTANCE, AND PARASITIC DUCT LOSSES. THE EQUATION CAN BE USED TO CALCULATE THE ELECTRODIALYSIS STACK RESISTANCE AND ELECTRICAL OPERATING COSTS IF SUCH OPERATING PARAMETERS AS WATER COMPOSITIONS, TEMPERATURE, TYPES OF MEMBRANES, STACK DESIGN, LIMITING CURRENT, OPERATING CURRENT AND FLOW RATES ARE KNOWN. (PB-207 655).

00895. INVESTIGATION OF MEMBRANE STACK RESISTANCE INCREASE WITH A NATURAL BRACKISH WATER.

FURUKAWA, D.H.
OSW-PR-285, 51 P, 1968.

THE OPERATION OF ELECTRODIALYSIS DEMINERALIZERS ON NATURAL WATER HAS RESULTED IN INCREASES IN MEMBRANE STACK ELECTRICAL RESISTANCE AFTER EXTENDED PERIODS. A PRIMARY RESISTANCE INCREASE DEVELOPS RAPIDLY DURING THE FIRST HOURS OF OPERATION AFTER WHICH A SECONDARY RESISTANCE INCREASE OCCURS AT A SLOWER RATE. THE RESISTANCE INCREASES ARE OF GREAT CONCERN BECAUSE OF THE INCREASE IN POWER CONSUMPTION WHICH CONTRIBUTES TO A HIGHER COST FOR PRODUCT WATER. LABORATORY INVESTIGATIONS INDICATED THAT THE MAJOR CAUSE OF THE RESISTANCE INCREASE IS AN ACCUMULATION OF AN IRON RICH GEL, WHICH INVOLVED THE REACTION OF FERROUS IONS IN THE FEED WATER WITH HYDROXIDE IONS WHICH FORM ON THE DISSOCIATION OF WATER (WATER SPLITTING). SULFURIC ACID INJECTED INTO THE DILUTION STREAM ELIMINATED THE SECONDARY RESISTANCE INCREASE WHEN THE PRODUCT ACIDITY WAS LOWERED TO PH 5.1. A COST ESTIMATE OF USING THIS TREATMENT IS GIVEN. (PB-207 656).

00896. HYDRAULIC DESIGN OPTIMIZATION OF THE ELECTRODIALYSIS PROCESS.

OSW-PR-325, 109 P, 1967.

THE OBJECTIVES OF THE PROGRAM WERE TO EXPAND THE CONVENTIONAL ELECTRODIALYSIS DESIGN EXPRESSIONS AND USE THE IMPROVED EXPRESSIONS TO DETERMINE THE RESEARCH AND DEVELOPMENT AREAS HAVING THE GREATEST POTENTIAL FOR PROCESS IMPROVEMENT. AFTER THE DEVELOPMENT OF A MATHEMATICAL EXPRESSION WHICH ENCOMPASSED THE VARIOUS IMPORTANT PARAMETERS, AN EXPERIMENTAL PROGRAM WAS DEVELOPED TO PERMIT THE FORMULATION OF THE HYDRAULIC PERFORMANCE OF ELECTRODIALYSIS SPACERS AND TO DEVELOP FUNCTIONAL RELATIONSHIPS BETWEEN THE LIMITING CURRENT DENSITY AND THE GEOMETRY OF ELECTRODIALYSIS SPACERS. FINALLY, THE ANALYTICAL PHASE OF THE WORK WAS CONCERNRED WITH THE EFFECTS ON THE OPTIMAL ELECTRODIALYSIS DESIGN AND MINIMUM COST OF CHANGES IN THE VARIOUS OPERATIONAL, TECHNOLOGICAL AND ECONOMIC PARAMETERS. (PB-207 659).

00897. OPERATION OF REVERSE OSMOSIS PILOT PLANTS.

DEHAVEN, C.G.; JARVIS, M.A.; WUNDERLICH, C.R.
OSW-PR-356, 147 P, 1968.

THE PURPOSE OF THE PROGRAM WAS THE SCALE-UP OF REVERSE OSMOSIS FROM A LABORATORY PROCESS TO AN ECONOMICAL SYSTEM FOR THE PRODUCTION OF POTABLE WATER IN LARGE AMOUNTS. THREE SERIES OF TESTS WERE CONDUCTED IN TWO 18 INCH CELLS AT THE NEWPORT BEACH, CALIFORNIA, SEAWATER SITE. 'T-SERIES' MEMBRANES (CELLULOSE ACETATE MEMBRANES BASED ON ACETONE AS THE POLYMER SOLVENT) WERE UTILIZED. NEXT, A NEW TYPE OF MEMBRANE USUALLY REFERRED TO AS THE 'U-SERIES' WAS TESTED. FORMED FROM A BLEND OF CELLULOSE DIACETATE AND TRIACETATE AND CAST FROM A MIXED SOLVENT OF ACETONE AND DIOXANE, THE U-SERIES MEMBRANES WERE SUPERIOR TO THE T-SERIES BOTH WITH RESPECT TO SALT REJECTION AND TO RESISTANCE TO COMPRESSION. THE THIRD SERIES OF SEAWATER TESTS WAS CONDUCTED TO EXAMINE THE FEASIBILITY OF TWO STAGE SEA WATER DESALINATION. (PB-207 633).

00898. ECONOMIC IMPACT OF ENVIRONMENTAL CONTROLS ON THE FRUIT AND VEGETABLE CANNING AND FREEZING INDUSTRIES. PART I. EXECUTIVE SUMMARY.

DUNLAP AND ASSOCIATES, P 585-PT-1, 23 P, 1971.

THE IMPLEMENTATION OF ENVIRONMENTAL CONTROLS NORMALLY RESULTS IN ADDED COSTS AND MAY RESULT IN ECONOMIC AND LOCATIONAL ADJUSTMENTS WITHIN THESE INDUSTRIES. THE STUDY SUMMARIZES THESE ADJUSTMENTS AS THEY RELATE TO THE FRUIT AND VEGETABLE PROCESSING INDUSTRIES IN TERMS OF COSTS, CAPITAL REQUIREMENTS, PROFITS, INDUSTRY STRUCTURE AND LOCATION, EMPLOYMENT, PRODUCT PRICES AND REGIONAL AND NATIONAL ECONOMIC IMPACTS. (PB-207 140).

00899. STUDY OF ECONOMIC IMPACTS OF POLLUTION CONTROL ON THE IRON FOUNDRY INDUSTRY. PART I. EXECUTIVE SUMMARY.

KEARNEY (A. T.) AND CO., CHICAGO, ILL. 20 P, 30 NOV 1971.

THE REPORT DISCUSSES ASPECTS OF THE IRON FOUNDRY INDUSTRY AS RELATED TO A STUDY ON THE ECONOMIC IMPACT OF POLLUTION CONTROL. THE CONTENTS INCLUDE: STRUCTURE OF THE INDUSTRY (DESCRIPTION OF THE IRON FOUNDRY INDUSTRY, DEMAND FOR IRON CASTINGS, SUPPLY OF IRON CASTINGS), OVERALL IMPACT ON INDUSTRY (PRICE INCREASES, FACTOR DISLOCATIONS WITHIN INDUSTRY, EFFECTS ON RELATED INDUSTRIES, INDUSTRY DISLOCATIONS, COMPENSATORY FACTORS, NET EMPLOYMENT IMPACT, IMPACT ON LOCAL ECONOMY). (PB-207 147).

00900. THE EFFECTS OF POLLUTION CONTROL ON THE NONFERROUS METALS INDUSTRIES. LEAD. PART I. INTRODUCTION AND EXECUTIVE SUMMARY.

CHARLES RIVER ASSOCIATES, INC., CAMBRIDGE, MASS., 32 P, DEC. 1971.

THE REPORT ON THE ECONOMIC EFFECTS OF POLLUTION CONTROLS ON THE LEAD INDUSTRY SUMMARIZES A BROADER STUDY, PROVIDES A BROAD PROFILE OF THE LEAD INDUSTRY AND OUTLINES THE ECONOMIC EFFECTS OF POLLUTION CONTROLS ON THE INDUSTRY. THE IMPORTANT POINTS AND CONCLUSIONS ARE PRESENTED. (PB-207 155).

00901. ANALYSIS OF ECONOMIC IMPACTS OF ENVIRONMENTAL STANDARDS ON THE BAKERY INDUSTRY. PART I.

ERNST AND ERNST, WASHINGTON, D.C., 6 P, DEC 1971.

THE REPORT SUMMARIZES PERTINENT INDUSTRY STRUCTURE AND TRENDS IN THE BAKERY INDUSTRY AND THE QUANTITATIVE AND QUALITATIVE FINDINGS CONCERNING THE ECONOMIC IMPACTS ON THE INDUSTRY OF ABATEMENT CONTROL EXPENDITURES. (PB-207 169).

00902. ENVIRONMENTAL QUALITY AND WATER DEVELOPMENT. VOLUME 1.

GOLDMAN, C.R.
NWC-EES-72-032-VOL-1, 597 P, 1971.

THE PURPOSE OF THE STUDY IS TO BRING TOGETHER WITHIN A SINGLE REPORT, AN EVALUATION OF THE CAUSES OF CONFLICT BETWEEN ENVIRONMENTAL QUALITY AND WATER ASSOCIATED DEVELOPMENT IN THE UNITED STATES. IT SURVEYS THE HISTORY OF WATER DEVELOPMENT AND THE EVOLUTION OF AMERICAN VALUES AND ATTITUDES TOWARD THE ENVIRONMENT. THE ENVIRONMENTAL PRESERVATION MOVEMENT IS DEFINED IN TERMS OF ITS DEMAND FOR, INTERPRETATION OF, AND ACCEPTANCE OF WATER RELATED AMENITIES. THE REPORT SUGGESTS METHODS FOR BALANCING HUMAN VALUES AGAINST COST BENEFIT ANALYSES. ELEVEN ARTICLES CONCERNING VARIOUS WATER PROBLEMS, SOURCES, AND IDEAS ARE ALSO PRESENTED. (PB-207 113).

REFERENCE LIST

00903. THE ECONOMIC IMPACT OF POLLUTION CONTROL: THE GENERAL ECONOMY.

CHASE ECONOMETRIC ASSOCIATES, INC., PHILADELPHIA, PA., 124 P, 1972.

THE REPORT SERVES AS A GENERAL SUMMARY AND BACKGROUND FRAME OF REFERENCE FOR THE DETAILED INDUSTRY REPORTS PREPARED FOR THE COUNCIL ON ENVIRONMENTAL QUALITY. IT ESTIMATES THE MACROECONOMIC EFFECT OF THE SUM OF THE REQUIREMENTS FOR POLLUTION CONTROL STANDARDS FOR ALL OF THE INDUSTRIES EXAMINED IN THOSE REPORTS. THE COSTS OF POLLUTION CONTROL HAVE BEEN TAKEN, AS ESTIMATED BY CEQ AND EPA, WHICH HAVE BEEN INCORPORATED IN THOSE REPORTS, AND HAVE APPLIED PRICE MARK UP FACTORS TO DETERMINE THE AMOUNT OF PRICE INCREASE AT THE INDUSTRY AND MACROECONOMIC LEVELS. ALSO ANALYZED ARE THE EFFECTS OF INCREASED INVESTMENT WHICH WILL BE REQUIRED BY EXISTING POLLUTION CONTROL LEGISLATION. (PB-207 204).

00904. THE ECONOMIC IMPACT OF POLLUTION CONTROL: A SUMMARY OF RECENT STUDIES.AN OVERVIEW.

CHASE ECONOMETRIC ASSOCIATES, INC., PHILADELPHIA, PA. 41 P, MARCH 1972.

THE PURPOSE OF THE OVERVIEW IS TO PUT INTO PERSPECTIVE STUDIES WHICH WERE CONDUCTED TO ASSESS THE ECONOMIC IMPACTS OF AIR AND WATER POLLUTION ABATEMENT REQUIREMENTS ON A NUMBER OF INDUSTRIAL ACTIVITIES. (PB-207 205).

00905. EXPLORATORY STUDY OF BRINE DISPOSAL USING FLUID BED EVAPORATION.

LAMONT, P.E.
OSW-RDPR-71-743, 113 P, NOV, 1971.

TO FACILITATE BRINE DISPOSAL AT INLAND SITES, AS WELL AS TO PROTECT THE ENVIRONMENT, IT MAY BE NECESSARY TO CONVERT THE WASTE BRINE TO SOLID SALTS. A NEW PROCESS USING FLUID BED EVAPORATION TO OBTAIN SOLID SALTS IS PRESENTED. THIS PROCESS DIFFERS FROM ORDINARY FLUID BED EVAPORATORS IN THAT THE SALT PARTICLES ARE FLUIDIZED BY SUPERHEATED STEAM. THE STEAM IS CONDENSED TO FURNISH ADDITIONAL PRODUCT WATER. EXPERIMENTAL DATA FROM A FOUR INCH FLUID BED EVAPORATOR IS DISCUSSED. COST ESTIMATES ARE GIVEN FOR A 2.5 MILLION GPD VERTICAL TUBE EVAPORATOR OR REVERSE OSMOSIS PLANT COMBINED WITH A FLUID BED EVAPORATOR. (PB-208 061).

00906. EVALUATION OF 75, 000 GPD SEA WATER DESULFATING PILOT PLANT.

GARRISON, K.M.; GUGLER, J.E.
INT-OSW-RDPR-71-746, 199 P, NOV 1971.

AN EVALUATION IS GIVEN OF THE OPERATION OF A 75,000 GPD PILOT PLANT USING THE CONTINUOUS ION EXCHANGE DESULFATION PROCESS FOR REMOVAL OF SULFATES FROM SEA WATER AS SETTLED BARIUM SULFATE. A COMMERCIAL STRONGLY ACID NUCLEAR SULFONIC CATION EXCHANGE RESIN WAS USED TO PRECIPITATE BARIUM SULFATE. RESIN WAS SEPARATED BY DECANTATION AND CONVERTED BACK TO THE SODIUM FORM BY MEANS OF SOLUBLE BARIUM CHLORIDE. DESULFATED SEA WATER WAS USED AS FEED TO THE MULTISTAGE FASH DISTILLATION PLANT WHICH RESULTED IN CONTINUOUS SCALE FREE OPERATION AT 350 F AND HIGH CONCENTRATION RATIOS. OPERATIONAL PROBLEMS AND AN ECONOMIC EVALUATION ARE INCLUDED. (PB-208 063).

00907. HYDROLYSIS LOSSES IN THE HYDRATE PROCESS FOR DESALINATION: RATE MEASUREMENT AND ECONOMIC ANALYSIS.

COLTEN, S.L.; LIN, F.S.; TSAO, T.C.; STERN, S.A.; BARDUHN, A.J.
INT-OSW-RDPR-72-753, 77 P, FEB 1972.

THE AGENTS USED IN THE HYDRATE PROCESS FOR DESALINATION VERY SLOWLY DECOMPOSE BY HYDROLYSIS IN WATER AND THE RATE AT WHICH THIS OCCURS HAS BEEN MEASURED FOR THE FOUR HYDRATING AGENTS. DATA ARE AVAILABLE IN THE LITERATURE ON TWO ADDITIONAL AGENTS, AND THE HYDROLYSIS RATES OF ALL SIX AGENTS ARE SUBJECTED TO ECONOMIC ANALYSIS TO DETERMINE THE COST TO THE PROCESS OF THE LOST AGENT. (PB-208 070).

00908. DESIGN STUDY OF LARGE MULTIPLE PHASE EJECTOR DRIVEN DESALINATION PLANTS.

HARPER, G.F.; LEIGH, J.H.
INT-OSW-RDPR-71-748, 79 P, OCT 1971.

LARGE SEA WATER DISTILLATION PLANTS DRIVEN BY MULTIPLE PHASE EJECTORS (MPE) WERE EVALUATED AND THE CHARACTERISTICS AND COSTS OF THE MOST PROMISING CONFIGURATIONS DETERMINED. THE OPTIMUM PLANT COMBINED A MULTISTAGE FLASH (MSF) FEED HEATER WITH VERTICAL TUBE EVAPORATOR (VTE) EFFECTS AND WAS SELECTED FOR MATHEMATICAL MODELING. THE PLANT CONSISTS OF 16 VTE EFFECTS WITH 42 MSF STAGES. A SINGLE EJECTOR DRIVES 4 OF THE VTE EFFECTS. ENERGY FOR THE SYSTEM IS FURNISHED BY A FOSSIL-FUEL FIRED BOILER. ELECTRICAL POWER IS FURNISEHD BY A STEAM TURBINE DRIVEN GENERATOR INTEGRAL WITH THE PLANT. THE WATER PRODUCTION, PERFORMANCE AND COSTS OF THE PLANT ARE REPORTED. (PB-208 065).

00909. POSSIBLE IMPACT OF COSTS OF SELECTED POLLUTION CONTROL EQUIPMENT ON THE ELECTRIC UTILITY INDUSTRY AND CERTAIN POWER INTENSIVE CONSUMER INDUSTRIES.

NATIONAL ECONOMIC RESEARCH ASSOCIATES, INC., NEW YORK, 105 P, 5 JAN 1972.

THE REPORT DISCUSSES THE EFFECT OF POLLUTION CONTROL ON THE ELECTRIC POWER INDUSTRY. FIRST, THE BASIC ECONOMIC STRUCTURE OF THE INDUSTRY IS PRESENTED. THIS INCLUDES DEMAND, GOVERNMENT REGULATION, FUELS USED, TRENDS, AND EMPLOYMENT. NEXT, THE ECONOMIC IMPACT OF THESE CONTROLS IS REVIEWED. THIS INCLUDES THE CAPITAL AND OPERATING COSTS WHICH ARE BROKEN DOWN BY GEOGRAPHICAL REGION. (PB-207 167).

00910. THE IMPACT OF COSTS ASSOCIATED WITH NEW ENVIRONMENTAL STANDARDS UPON THE PETROLEUM REFINING INDUSTRY.

SOBOTKA (STEPHEN) AND CO., NEW YORK, 16 P, 23 NOV 1971.

THE STUDY SUMMARIZES THE ECONOMIC IMPACT OF POLLUTION ABATEMENT COSTS WHICH RESULT FROM REGULATION OF PETROLEUM REFINERY OPERATIONS. IT IS

AIMED AT DETERMINING THE IMPACT OF THE COSTS OF CONTROLLING REFINERY AIRBORNE AND WATERBORNE EMISSIONS. (PB-207 197).

00911. COMPUTER CODES FOR OFFICE OF SALINE WATER PROGRAM ANALYSIS.

OAK RIDGE NATIONAL LAB., TENN., 275 P. JAN 1972.

PART I. ECON-21. A FORTRAN CODE IS GIVEN FOR THE CALCULATION OF COST EFFECTIVENESS INDEX AND ACCUMULATED BENEFITS EVALUATION OF IMPROVEMENTS TO DESALINATION PROCESSES. (ORNL-TM-2525 PT. 1).

00912. COST ANALYSIS OF OPTIONAL METHODS OF SHIPBOARD DOMESTIC WASTE DISPOSAL.

PIERSALL, C.H.JR; BORGSTROM, R.E.
REPT NO. CNA- PROFESSIONAL PAPER 91, 31 P, JAN 72.

THE PAPER DISCUSSED FOUR OPTIONAL METHODS FOR THE DISPOSAL OF SHIPBOARD DOMESTIC WASTES. THE ANNUALIZED INVESTMENT AND OPERATING COSTS ASSOCIATED WITH THE IMPLEMENTATION OF EACH OF THE OPTIONS ARE PRESENTED. ESTIMATES WERE DEVELOPED ON A PER SHIP PER CLASS BASIS AND AGGREGATED FOR THE TOTAL SURFACE FLEET. THIS APPROACH PERMITS THE INVESTIGATION OF DIFFERENT COMBINATIONS OF THE OPTIONS BY MERELY SPECIFYING THE NUMBER AND TYPE OF SHIPS TO BE CONSIDERED IN ANY OPTION. (AD-744 192).

00913. SYSTEM STUDY, VACUUM SEWAGE COLLECTION.

WALLER, R.; MALLORY, C.W.
HIT-510-NCEL-CR-72.015, 114 P. 1971.

AN EFFECTIVENESS/COST COMPARISON WAS MADE BETWEEN GRAVITY SEWER SYSTEMS AND VACUUM SEWER SYSTEMS FOR USE IN NAVY ADVANCED BASES. ESTIMATES OF THE DAILY AND PEAK WASTEWATER FLOWS WERE DEVELOPED FOR A 500 MAN BASE FOR BOTH VACUUM TOILETS AND FOR LOW FLUSH WATER TOILETS. (AD-744 339).

00914. ECONOMIC VALUE OF WATER: CONCEPTS AND EMPIRICAL ESTIMATES.

YOUNG, R.A.; GRAY, S.L.; HELD, R.B.; MACK, R.S.
NWC-SBS-72-047, MAR 72, 348 P.

THE STUDY WAS DIVIDED INTO TWO PARTS. IN THE FIRST PART A NUMBER OF ISSUES ARE EXAMINED THAT MUST BE TAKEN INTO ACCOUNT IN DERIVING CONCEPTUALLY VALID ESTIMATES OF THE VALUES OF WATER. THE SECOND PART INVOLVES ANALYSIS OF WATER VALUES FOR VARIOUS USES WITH ATTENTION TO REGIONAL DIFFERENCES. THIS ANALYSIS EMPLOYS THE CONCEPTUAL APPROACH DEVELOPED INITIALLY AND CONSIDERS NUMEROUS PREVIOUS STUDIES FROM AN EXHAUSTIVE LITERATURE REVIEW. (PB-210 356).

00915. ECONOMIC VALUE OF WATER IN A SYSTEMS CONTEXT.

BUTCHER, W.R.; WHITTLESEY, N.K.; ORSBORN, J.F.
NWC-SBS-72-048, MAY 72, 188 P.

THE INTERDEPENDENT SYSTEM, IN WHICH WATER RESOURCES OCCUR AND USES TAKE PLACE, MAKES IT IMPORTANT TO CONSIDER WATER VALUES IN A SYSTEMS CONTEXT. SYSTEMS MODELS PROVIDE THE MOST SYSTEMATIC APPROACH TO ESTIMATING THE VALUES BUT MUCH CAN BE LEARNED THROUGH A CAREFUL DESCRIPTION OF EFFECTS THAT EACH USE HAS NOT ONLY ON QUANTITY OF WATER BUT ALSO ON QUALITY AND TIME OR PLACE OF AVAILABILITY. (PB-210 357).

00916. THE CEMENT INDUSTRY: ECONOMIC IMPACT OF POLLUTION CONTROL COSTS. VOLUME I. EXECUTIVE SUMMARY.

BOSTON CONSULTING GROUP, INC., MASS., 15 P, NOV 71.

THE REPORT SUMMARIZES THE ECONOMIC IMPACT OF POLLUTION CONTROL ON THE CEMENT INDUSTRY. SUMMARIZED IS THE STRUCTURE OF THE INDUSTRY ALONG WITH AREAS TO BEAR THE MAJOR IMPACT. SUCH AREAS INCLUDE PRICES, EMPLOYMENT, AND SHUTDOWNS. (PB-207 150).

00917. THE LEATHER INDUSTRY: A STUDY OF THE IMPACT OF POLLUTION CONTROL COSTS. VOLUME I. EXECUTIVE SUMMARY.

URBAN SYSTEMS RESEARCH AND ENGINEERING, INC., CAMBRIDGE, MASS. DEC. 71, 27.

THE REPORT SUMMARIZES A REVIEW OF THE IMPACT OF POLLUTION CONTROL COSTS ON THE LEATHER TANNING AND FINISHING INDUSTRY IN THE UNITED STATES. THE SUMMARY PRESENTS AN OVERVIEW OF THE TOTAL STUDY HIGHLIGHTING THE INDUSTRY TRENDS AND THE RELATIVE IMPORTANCE OF POLLUTION CONTROL COSTS TO THE FUTURE OF THE INDUSTRY. (PB-207 152).

00918. ECONOMIC IMPACT OF ANTICIPATED PAPER INDUSTRY POLLUTION. ABATEMENT COSTS. PART I. EXECUTIVE SUMMARY.

LITTLE (ARTHUR D.), INC., CAMBRIDGE, MASS. ADL-C-73977-PT-1, 19 P, NOV 71.

THE ANALYSIS PROVIDES FOR ASSESSMENT OF THE ECONOMIC IMPACT ON THE PAPER AND RELATED INDUSTRIES THAT WILL RESULT FROM THE AIR AND WATER POLLUTION CONTROL REQUIREMENTS ANTICIPATED THROUGH 1976. THE ANALYSIS IS MEANT TO PROVIDE INFORMATION THAT CAN BE USED IN FORMULATING FEDERAL POLICY FOR POLLUTION ABATEMENT PROGRAMS IN THE PAPER INDUSTRY OVER THE NEXT FIVE YEARS. DISCUSSED ARE THE FOLLOWING: INDUSTRY STRUCTURE; PROFITABILITY TREND; PRICE IMPACT; MILL SHUTDOWN AND PROBABILITIES; EMPLOYMENT IMPACT; INDIRECT IMPACTS. (PB-207 144).

00919. INTERIM DEVELOPMENT GUIDE AND PROGRAM FOR WATER AND WASTE MANAGEMENT.

HUD-CIR-332, 134 P, JUNE 71.

THE REPORT PRESENTS A BROAD PICTURE OF THE NORTH LOS ANGELES COUNTY AREA FROM A REGIONAL PLANNING VIEWPOINT AND SUMMARIZES THAT PRELIMINARY STAFF FINDINGS AND RECOMMENDATIONS WILL SERVE AS A DEVELOPMENT GUIDE DURING THE PERIOD THAT FURTHER AND MORE DETAILED AIRPORT IMPACT STUDIES ARE IN PROGRESS. MAJOR SYSTEM PLANS FOR WATER DISTRIBUTION, DRAINAGE CONTROL AND SEWERAGE FACILITIES ARE INVENTORIED, ANALYZED, MAPPED, AND COSTS PROJECTED. (PB-210 802).

REFERENCE LIST

00920. THE REUSE OF WATER IN MANUFACTURING: AN EXPLANATORY ECONOMIC MODEL WITH DATA ANALYSIS.

BROWN, F.L.
OSRR-B-017-NMEX (1), 32 P, JAN 1972.

AN EXPLANATORY ECONOMIC MODEL IS PROPOSED FOR THE DETERMINATION OF WATER REUSE RATES BASED ON THE CLASSICAL THEORY OF THE FIRM AS A COST MINIMIZING INSTITUTION. THE FIRM'S WATER BEHAVIOR IS CONCEPTUALIZED AS CONSISTING OF A FINITE SET OF INTERDEPENDENT RELATIONSHIPS WITH EACH RELATIONSHIP REPRESENTING SOME SPECIFIC SEGMENT OF THE ENTIRE OPERATION. THE INDIVIDUAL RELATIONS WERE CONSTRUED AS JOINTLY OR SIMULTANEOUSLY PROVIDING A THEORETICAL REPRESENTATION OF THE ENTIRE ONGOING MANUFACTURING OPERATION. (PB-207 138) (W72-05093).

00921. COST OF RECLAMATION AND MINE DRAINAGE ABATEMENT - ELKINS DEMONSTRATION PROJECT.

SCOTT, R.B.; HILL, R.D.; WILMOTH, R.C.
EPA- 14010-10/70, 29 P, 1970.

ACID MINE DRAINAGE, DISCHARGING FROM COAL BEDS, POLLUTES STREAMS AND RIVERS. AN ACID MINE DRAINAGE RECLAMATION PROJECT WAS ESTABLISHED IN THE ROARING CREEK GRASSY RUN WATERSHED NEAR ELKINS, WEST VIRGINIA. THE CONTROL COSTS ESTABLISHED FROM THE PROJECT ARE PRESENTED. THE COSTS INCLUDE THOSE FOR CLEARING, GRUBBING, RECLAMATION, AND REVEGETATION. (PB-207 189) (W72-04587).

00922. REUSE OF CHEMICAL FIBER PLANT WASTEWATER AND COOLING WATER BLOWDOWN.

EPA-WQO-12090EUX-10/70, 70 P, OCT 1970.

A WATER REUSE PROGRAM WAS INSTITUTED WHICH CONSISTED OF : (1) PRETREATMENT OF COOLING WATERS FOR REMOVAL OF HEAVY METALS; (2) INPLANT MODIFICATIONS AND ADDITIONS TO THE EXISTING SYSTEM TO INCREASE TREATMENT PLANT CAPACITY; AND (3) A POST TREATMENT SYSTEM FOR EFFLUENT POLISHING PRIOR TO SELECTED REUSE. CHROMIUM WAS REMOVED FROM THE COOLING TOWER BLOWDOWN FOR $. 21 PER POUND OF CHROMATE REMOVED. THE 0.33 MGD INDUSTRIAL AND DOMESTIC WASTE WATER WAS TREATED AND REUSED AT A RATE OF 3.10 MGD FOR APPROXIMATELY 40 CENTS/1000 GALLONS. (PB-200 695) (W71-09524).

00923. ACTIVATED SLUDGE PROCESSING.

ENVIRONMENTAL PROTECTION AGENCY WATER POLLUTION CONTROL RESEARCH SERIES, FEB 1972. 164 P.

A TWO PHASE, FULL SCALE INVESTIGATION OF THE EFFECTS OF HIGH PURITY OXYGEN AERATION IN THE ACTIVATED SLUDGE PROCESS WAS CONDUCTED AT THE BATAVIA, NEW YORK, MUNICIPAL POLLUTION CONTROL PLANT. SOLIDS AND MASS BALANCES WERE PERFORMED FOR EACH WEEK OF OPERATION TO EVALUATE IN DEPTH THE SOLIDS PROFILE THROUGH THE OXYGENATION SYSTEM. FILTERING CHARACTERISTICS OF WASTE ACTIVATED SLUDGE FROM THE OXYGENATION SYSTEM WERE EXCELLENT. WASTE ACTIVATED SLUDGE WAS ALSO AEROBICALLY DIGESTED IN 800 GALLON BATCHES USING PURE OXYGEN. COSTS FOR BOTH SYSTEMS FOR 1 MGD FLOWS WERE COMPARABLE, BUT SAVINGS OF AS MUCH AS 20% WERE PROJECTED FOR 100 MGD PLANTS USING OXYGENATION. (PB-209 940) (W72-09389).

00924. LIQUID WASTES FROM CANNING AND FREEZING FRUITS AND VEGETABLES.

ENVIRONMENTAL PROTECTION AGENCY WATER POLLUTION CONTROL RESEARCH SERIES, AUGUST 1971. 158 P.

IT HAS BEEN ESTIMATED THAT THE APPROXIMATELY 1800 PLANTS IN THE CANNED AND FROZEN FRUITS AND VEGETABLES INDUSTRY IN THE U. S. ANNUALLY UTILIZE 26 MILLION TONS OF RAW PRODUCT, DISCHARGE 83 BILLION GALLONS OF WASTEWATER, GENERATE 800 MILLION POUNDS OF BOD AND 392 MILLION POUNDS OF SUSPENDED SOLIDS, AND PRODUCE 8 MILLION TONS OF SOLID RESIDUALS. SEVERAL CONVENTIONAL WASTE TREATMENT METHODS ARE PRESENTED, ALONG WITH THEIR POTENTIAL APPLICATION TO THE FOOD PROCESSING INDUSTRY. LIQUID WASTE TREATMENT AND/OR DISCHARGE COSTS FOR A SYNTHETIC AVERAGE PLANT IN THE INDUSTRY ARE ESTIMATED AT $18,000/YEAR OR $1.30 PER TON OF RAW PRODUCT, INCLUDING ANNUAL CAPITAL AND OPERATION AND MAINTENANCE COSTS. (PB-209-941)(W72-09390.

00925. COST OF WASTE TREATMENT IN THE MEAT PACKING INDUSTRY.

CAMIN, K.Q.
PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 25TH, MAY 5-7, 1970. PURDUE UNIVERSITY ENGINEERING EXTENSION SERIES NO. 137, P 193-202.

THE FOUR BASIC ALTERNATIVES OPEN TO THE MEAT PACKING INDUSTRY FOR WASTE DISPOSAL ARE: (1) INDUSTRIAL WASTE TREATMENT IN FACILITIES OWNED AND OPERATED BY THE INDUSTRY; (2) INDUSTRIAL WASTE TREATMENT FOLLOWED BY TREATMENT IN A MUNICIPAL WASTE TREATMENT PLANT; (3) TREATMENT IN A MUNICIPAL WASTE TREATMENT PLANT ONLY; AND (4) NO TREATMENT. THE VARIOUS TREATMENT METHODS OF CATCH BASINS, AIR FLOTATIONS, LAGOON SYSTEMS, TRICKLING FILTERS, ACTIVATED SLUDGE, ANAEROBIC CONTACT AND CHANNEL AERATION ARE ANALYZED INDIVIDUALLY AS TO GROSS WASTE LOAD TREATED, GROSS WASTE LOAD REMOVED, AND WASTE LOAD REMOVED PER DOLLAR INVESTED. AN ANALYSIS OF TOTAL PAYMENTS BY THE MEAT PACKING INDUSTRY TO MUNICIPALITIES IN 1966 IS ALSO PRESENTED, SHOWING AN $8.003 MILLION TOTAL FOR THE YEAR. (W72-09397).

00926. EFFECT OF WATER CONDITIONING ON WASTEWATER QUALITY.

WILLIAMS, J.W.
JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 60(12), 1329-1335, 1968.

SOFTENING COSTS AT FILTRATION PLANTS ARE AS LOW AS $0.03/1000 GAL/100 PPM HARDNESS REMOVED. UNIT COSTS ARE HIGHER FOR LIME SODA ASH SOFTENING WHEN SIGNIFICANT NON-CARBONATE HARDNESS IS PRESENT.

00927. A NEW METHOD FOR THE TREATMENT OF MUNICIPAL WASTEWATER.

JORGENSEN, S.E.
WATER POLLUTION CONTROL, 71(2), 210-215, 1972.

A NEW WASTEWATER TREATMENT SYSTEM INVOLVES A COMBINATION OF TWO WELL KNOWN PROCESSES. AFTER GRIT REMOVAL, EITHER ALUMINUM SULFATE, IRON CHLORIDE, OR CALCIUM HYDROXIDE IS ADDED TO THE INFLUENT TO INDUCE CHEMICAL PRECIPITATION. AFTER 1

1/2 HOURS OF SETTLING, THE OVERFLOW IS TREATED BY A CATIONIC EXCHANGER CONSISTING OF SULPHONATED LIGNO CELLULOSE, FOLLOWED BY A ANION EXCHANGER. COMPARISONS BETWEEN CONVENTIONAL MECHANICAL-BIOLOGICAL TREATMENT AND DATA OBTAINED FROM A 4.5 CU M/HR PILOT WERE MADE. PRODUCT WATER PRODUCED IS SUPERIOR IN QUALITY TO MOST SURFACE WATER SUPPLIES. (W72-09830).

00928. HEAT TREATMENT PROCESS IMPROVES ECONOMICS OF SLUDGE HANDLING AND DISPOSAL.

SHERWOOD, R.; PHILLIPS, J.

WATER AND WASTES ENGINEERING, 7(11), 42-44, 1970.

THE PORTEUS SLUDGE HEAT TREATMENT PROCESS IS BEING SUCCESSFULLY APPLIED AT COLORADO SPRINGS, COLORADO, FOR VOLUME REDUCTION OF MUNICIPAL SLUDGE. THE PROCESS COMPONENTS INCLUDE A LARGE GRINDER, HIGH PRESSURE (250 PSIG DISCHARGE) POSITIVE DISPLACEMENT PUMPS, AND A STEAM HEATED PRESSURE VESSEL WITH SUFFICIENT VOLUME TO PROVIDE 30 MIN. RETENTION TIME. PRIOR TO INSTALLATION OF THE PORTEUS PROCESS, A 5% SOLIDS SLUDGE STEAM WAS DEWATERED DIRECTLY ON A VACUUM FILTER TO A 20% SOLIDS SLUDGE STREAM FOR HAULAGE TO A LANDFILL. CHEMICAL COST ALONE FOR SLUDGE CONDITIONING CHEMICALS WAS $18 TO $20 PER TON DRY SOLIDS PRODUCED. VACUUM FILTER RATES OF 5 LB PER SQ FT PER HOUR WERE COMMON WITH THE PREVIOUS METHOD. INSTALLATION OF THE PORTEUS SYSTEM HAS BOOSTED VACUUM FILTRATION RATES TO AN AVERAGE OF 121 LB PER SQ FT PER HOUR, RESULTING IN A FILTER CAKE WITH 40 TO 50% SLUDGE SOLIDS CONTENT WITH NO CONDITIONING CHEMICALS NECESSARY. COST OF THE PORTEUS PROCESS IS $2/TON DRY SOLIDS. (W72-09833).

00929. INDUSTRIAL WASTE TREATMENT IN THE U S A TODAY.

THIEME, R.W.

PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 25TH, MAY 7-9, 1970, PURDUE UNIVERSITY ENGINEERING EXTENSION SERIES NO. 137, P 725-730.

INDUSTRIAL WASTES WERE COMPARED TO OTHER MAJOR SOURCES OF POLLUTION, NAMELY MUNICIPAL SEWAGE AND AND AGRICULTURAL WASTES. WASTE WATER DISCHARGES FROM THE MAJOR INDUSTRIES EXCEED 13 TRILLION GALLONS ANNUALLY VERSUS 5 TRILLION GALLONS OF DOMESTIC WASTE WATER FROM THAT PART OF THE POPULATION SERVED BY SEWERS. THE INTERIOR DEPARTMENT HAS DEVELOPED A POLICY OF JOINT TREATMENT OF INDUSTRIAL AND MUNICIPAL WASTES WHENEVER POSSIBLE WITH INDUSTRY TO PAY ITS FAIR SHARE OF THE COST OF TREATMENT. REUSE AND RECYCLING CONCEPTS SHOULD RECEIVE INCREASED CONSIDERATION BY INDUSTRY. SINCE CHARGES RELATING TO THE VOLUME AND STRENGTH WILL BE RENDERED FOR A WASTE DISCHARGED INTO A MUNICIPAL SYSTEM, IT SHOULD BE AN INCENTIVE TO INDUSTRY TO CUT DOWN ON WASTES. (W72-09835).

00930. TREAT HYDROCARBON PROCESSING INDUSTRIAL WASTES WITH BUTS.

SKOGEN, D.B.

PROCEEDINGS, INDUSTRIAL WASTE CONFERENCE, 25TH, MAY 7-9, 1970, PURDUE UNIVERSITY ENGINEERING EXTENSION SERIES NO. 137, P 721-724.

THE CONTINENTAL OIL COMPANY HAS REDUCED MAJOR POLLUTANTS IN THE WASTEWATER EFFLUENT OF ITS BILLINGS REFINERY BY OVER 90 PERCENT BY THE USE OF THREE WASTEWATER COLLECTION AND TREATMENT SYSTEMS. THE FIRST SYSTEM TREATS SOUR WATER CONTAMINATED WITH PHENOLS, SULFIDES AND AMMONIA BY STEAM STRIPPING, FOLLOWED BY TWO AERATED BIOLOGICAL OXIDATION PONDS THAT OPERATE IN SERIES. THE EFFLUENT FROM THE BIOLOGICAL PONDS FLOWS INTO THE FIRST OF TWO AERATED HOLDING PONDS. THE SECOND SYSTEM TREATS ALL OILY WATERS BY THE USE OF AN API OIL SEPARATOR WITH THE OIL FREE WATER PUMPED INTO THE FIRST BIOLOGICAL OXIDATION POND. THE THIRD SYSTEM TREATS THE BOILER PLANT BLOWDOWN AND THE RECIRCULATING COOLING WATER SYSTEM BLOWDOWNS FOR SOLIDS REMOVAL BY SEDIMENTATION WITH THE CLEAR WATER BEING PUMPED INTO THE SECOND HOLDING POND FOR FURTHER AERATION. THE AMOUNT OF WATER BIOLOGICALLY TREATED AVERAGED 22K GPM, AND TOTAL DAILY OPERATING COSTS OF 145 DOLLARS PER DAY WERE REPORTED ALONG WITH OPERATING COSTS FOR EACH SEGMENT OF THE TREATMENT PLANT. (W72-09837).

00931. COST BENEFIT ANALYSIS FOR WATER RESOURCE PLANNING ONTARIO.

CLOUGH, D.J.

COST BENEFIT ANALYSIS, A SYMPOSIUM HELD IN THE HAGUE, JULY 1969. THE ENGLISH UNIVERSITIES PRESS, LTD., LONDON, 1971, M.G. KENDALL, EDITOR, P 237-251.

THE APPLICATION OF COST BENEFIT ANALYSIS TO RIVER SYSTEM PLANNING IS CIRCUMSCRIBED BY FOUR IMPORTANT CONDITIONS. FIRST, WATER RESOURCE DEVELOPMENT PROJECTS ARE FINANCED BY FEDERAL, PROVINCIAL, AND MUNICIPAL GOVERNMENTS. CONSEQUENTLY, THE PROJECTS ARE ADMINISTERED BY A NUMBER OF GOVERNMENT DEPARTMENTS, WITH EACH ESPOUSING ITS OWN OBJECTIVES AND POLICIES. SECOND, VARIOUS NON-GOVERNMENTAL GROUPS ENTER INTO THE DECISION-MAKING PROCESS. THIRD, EXISTING THEORIES AND MODELS FOR THE MEASUREMENT OF ECONOMIC VALUES ARE INADEQUATE. NEVERTHELESS, THEY ARE NECESSARY EXPEDIENTS FOR DECISION-MAKING. FOURTH, FEW PROFESSIONAL ANALYSTS HAVE ENOUGH BROAD PROFESSIONAL COMPETENCE TO INTEGRATE AND ASSESS THE CONTRIBUTIONS OF ALL THE DISCIPLINES INVOLVED WITH ANY PROJECT. THE PROBLEMS THESE FOUR CONSTRAINTS POSE FOR COST BENEFIT ANALYSIS ARE DISCUSSED WITHIN THE FRAMEWORK OF RIVER SYSTEM PLANNING IN ONTARIO, CANADA. (W72-10427).

00932. POLLUTION PRICES IN A GENERAL EQUILIBRIUM MODEL.

RUFF, L.E.

INSTITUTE OF MARINE RESOURCES REF. NO. 72-3, SEA GRANT PUBLICATION NO. 12, MAY 1970. 25 P.

MANY PRESSING POLLUTION PROBLEMS CAN BE SOLVED EFFICIENTLY USING TRADITIONAL ECONOMIC ANALYSIS. IT IS ARGUED THAT BENEFIT COST ANALYSIS AND DIRECT REGULATION ARE TOTALLY INADEQUATE TOOLS FOR THE MORE COMPLEX POLLUTION PROBLEMS. A POLITICAL ECONOMIC PROCESS IS PROPOSED AND OUTLINED. ULTIMATELY, INSTITUTIONS MUST BE DESIGNED WHICH WILL ALLOW EXPLICIT POLITICAL DECISIONS WHERE REQUIRED, ALLOW ECONOMIC CALCULATION WHERE

POSSIBLE, AND PROVIDE SUFFICIENT FEEDBACK BETWEEN THE ECONOMIC AND POLITICAL MECHANISMS SO THAT THE SYSTEM IS RESPONSIVE, STABLE, AND EFFICIENT. A SIMPLE EXTENSION OF STANDARD GENERAL EQUILIBRIUM MODELS IS USED TO ANALYZE GENERAL EQUILIBRIUM WITH POLLUTION PRICES. A PRICE SYSTEM MAY BE ABLE TO REDUCE POLLUTION EFFICIENTLY WITH A MINIMUM OF INFORMATION AND INTERFERENCE, AND PROVIDE ESTIMATES OF COSTS OF FURTHER REDUCTION, ALLOWING POLITICAL DECISIONS ABOUT DESIRED POLLUTION LEVELS TO BE MADE SIMPLY AND RATIONALLY. (COM-721 10118) (W72-09235).

00933. POLLUTION ABATEMENT AND UNEMPLOYMENT. A METHODOLOGICAL STUDY.

HOICKA, J.; TRUMBULL, T.; SCOTT, H.
APTD-0921, 154 P, 31 JAN 1972.

A REPORT IS PRESENTED OF A STUDY WHICH DEVELOPS A METHODOLOGY TO ESTIMATE THE MAGNITUDE OF UNEMPLOYMENT THAT MAY BE EXPECTED AS A RESULT OF PLANT CLOSURES CAUSED BY POLLUTION ABATEMENT REQUIREMENTS. THIS STUDY IS DIRECTED AT THE VERY SMALL MINORITY OF PLANTS THAT MIGHT REDUCE OR CEASE OPERATIONS AND THEREBY LAY OFF THEIR EMPLOYEES. THE REPORT SPECIFIES THE TYPES OF FINANCIAL ASSISTANCE REQUIRED TO AVOID CLOSURE, AND DESCRIBES THE KINDS OF PLANTS AFFECTED AND PROGRAMS WHICH MIGHT BE INSTITUTED SHOULD THE NEED ARISE. THE STUDY ALSO PROVIDED INSIGHTS INTO THE APPROPRIATE TYPES OF FEDERAL GOVERNMENT RESPONSE, SHOULD THE MAGNITUDE OF UNEMPLOYMENT WARRANT ACTION. (PB-207 109).

00934. A COMPILATION OF COST INFORMATION FOR CONVENTIONAL AND ADVANCED WASTEWATER TREATMENT PLANTS AND PROCESSES.

SMITH, R.
EPA-17090-12/67, 55 P, DEC 1967.

THE COST ASSOCIATED WITH BUILDING AND OPERATING WASTEWATER TREATMENT PLANTS OR INDIVIDUAL WASTEWATER PROCESSES HAS ALWAYS BEEN DIFFICULT TO ESTIMATE FOR PLANNING PURPOSES. A GREAT DEAL OF INFORMATION IS AVAILABLE AND AN ATTEMPT HAS BEEN MADE TO ASSEMBLE THIS INFORMATION IN ONE PLACE USING A CONSISTENT SET OF ASSUMPTIONS AND OMISSIONS. IT IS HOPED THAT THIS WILL PROVE A USEFUL WORKING DOCUMENT FOR ENGINEERS AND SCIENTISTS WORKING IN THE FIELD OF WASTEWATER TREATMENT. COSTS FOR CONVENTIONAL TREATMENT PLANTS INCLUDE THOSE FOR PRIMARY SEDIMENTATION, ACTIVATED SLUDGE AND TRICKLING FILTER PLANTS. ADVANCED TREATMENT PROCESSES CONSIDERED IN THIS COLLECTION ARE: SOLIDS REMOVAL BY COAGULATION AND SEDIMENTATION; FILTRATION THROUGH SAND OR GRADED MEDIA; AMMONIA STRIPPING, GRANULAR CARBON ADSORPTION; ELECTRODIALYSIS, MICROSTRAINING OF SECONDARY EFFLUENT; AERATION OF SECONDARY EFFLUENT; CHLORINATION OF SECONDARY EFFLUENT; AND PIPELINES FOR ULTIMATE DISPOSAL. ALSO, ADDED ARE CONSTRUCTION COSTS FOR INDIVIDUAL EQUIPMENT, STRUCTURES AND CONSUMABLE ITEMS. COSTS ARE NORMALIZED TO JUNE 1967 AND ARE PRESENTED AS NATIONAL AVERAGES TO ALLOW ADJUSTMENT OF THESE FIGURES TO REFLECT CURRENT COST INDICES AND LOCAL SITUATIONS. THIS IS NOT A COMPLETE CONSIDERATION OF THE SUBJECT, BUT IS A COMPILATION OF A VERY LARGE AMOUNT OF DATA IN ONE DOCUMENT AND IN A FORM SUITABLE FOR USE BY THOSE IN THE WASTEWATER TREATMENT FIELD. (W72-04298) (PB-206 430).

00935. ECONOMIC AND TECHNICAL ASPECTS OF THE USE OF MATHEMATICAL MODELS IN STATE WATER RESOURCES PLANNING PROGRAMS.

VIESSMAN, W.JR.
OWRR-A-016-NEB (1), 36 P, SEP 1970.

THE PROJECT WAS DESIGNED TO EXPLORE THE ECONOMICS OF INSTITUTING A SERIOUS MODELING EFFORT WITHIN A STATE WATER PLANNING AGENCY AND TO ASSESS THE TECHNICAL LIMITATIONS ON THE USE OF CURRENT MODELS FOR SOLVING PLANNING-ORIENTED PROBLEMS. (PB-196 365) (W71-02879).

00936. CENTRIFUGE FOR DEWATERING SLUDGES.

ALBERTSON, O.E.; SHERWOOD, R.J.
WATER & WASTE ENG., 5, 56-57, APRIL 1968.

THIS ARTICLE GIVES COSTS OF DEWATERING DIGESTED SLUDGES BY THE USE OF CENTRIFUGES..

00937. DENVER BUILDS A WASTE TREATMENT PLANT.

OMBRUNI, P.R.
WATER & WASTE ENG., 5, 52-55, FEB 1968.

A WASTE-TREATMENT PLANT FOR DENVER COLORADO COST $17,300,000. AN ITEMIZED LIST OF EQUIPMENT AND OTHER DESIGN CHARACTERISTICS ARE GIVEN..

00938. EIGHTEENTH OKLAHOMA INDUSTRIAL WASTE CONFERENCE.

H. GLADYS SWOPE (ED), 115, 244-246, MAY 1968.

THIS ARTICLE, BASED ON PAPERS PRESENTED AT THE CONFERENCE, CONTAINS COST DATA FOR MICROSTRAINING, ACTIVATED CARBON TREATMENT, REVERSE OSMOSIS, DISTILLATION, AND OXIDATION..

00939. FLAME INCINERATION.

BREWE, G.C.
CHEM. ENG., 75, 160-165, OCT. 14, 1968.

CAPITAL AND ANNUAL COSTS ARE GIVEN FOR REMOVAL OF ODOR-CAUSING GASES AND VAPORS BY FLAME, THERMAL, AND CATALYTIC INCINERATION.

00940. HEAT SYNERESIS OF SEWAGE SLUDGES.

HARRISON, J.; BUNGAY, H.R.; LORD, A.M.
WATER & SEWAGE WORKS, 115, 268-273, JUNE 1968.

A BREAKDOWN OF CAPITAL AND OPERATING COSTS FOR HEAT-TREATMENT SYSTEMS WITH AND WITHOUT HIGH-PRESSURE PUMPING ARE GIVEN.

00941. OIL-SPILL CLEANUP: A MATTER OF $'S AND METHODS.

PATTISON, D.A.
CHEM. ENG., 76, 50-54, FEB. 10, 1969.

COSTS ARE GIVEN FOR VARIOUS OIL-SPILL TREATMENTS IN TERMS OF COST PER GALLON OF PRODUCT AND COST PER GALLON OF OIL TREATED.

00942. PRODUCTION COST FACTOR IN RATE-MAKING.

HEANEY, J.P.; GEMMELL, R. S.
J AM. WATER WORKS ASSOC., 61, 102-106, MARCH 1969.

THE RELATIONSHIP BETWEEN PRODUCTION COSTS FOR WATER TREATMENT SYSTEMS AND RATES CHARGED FOR WATER IS DISCUSSED.

00943. PROTECTING PUMPING STATION AGAINST NUCLEAR ATTACK.

BECKER, E.W.
J AMERICAN WATER WORKS ASSOCIATION, 61, 392-394, AUGUST 1969.

WATER PUMPING STATIONS OF THE CITY OF MILWAUKEE HAD THE FOLLOWING COSTS: HOWARD AVE. STATION, 271-MGD, $1,557,486 IN 1962, OR $5,830-MILLION GAL. ; TEXAS AVE. STATION, 140-MGD, $2,084,197 IN 1962 OR $14,850/MILLION GAL. ; NORTH POINT STATION, 165-MGD, $2,376,000 IN 1963, OR $14,400/MILLION GAL..

00944. THE INDIRECT CYCLE OF WATER REUSE.

TCHOBANOGLOUS, G. ; ELIASSEN, R.
WATER & WASTES ENG., 6, 35-41 FEB. 1969.

UNIT COSTS IN $/ACRE-FT AND $/1,000 GAL. ARE GIVEN FOR VARIOUS RECLAMATION PROCESSES.

00945. THE RECLAMATION OF POTABLE WATER FROM WASTEWATER.

STANDER, G.J.; VAN VUUREN, L.R.J.
J WATER POLLUTION CONTROL FED., 41, 355-267, 1969.

A DISCUSSION, WITH COSTS OF POTABLE WATER RECLAMATION FROM HUMUS TANK EFFLUENT AND PRIMARY CLARIFIED WASTEWATER IS GIVEN.

00946. TREAT SOUR WATER WATER BY ION EXCHANGE.

POLLIO, F.X.; PETRALIA, J.W.
HYDROCARBON PROCESSING, 48, 124-126, MAY 1969.

A PLANT FOR PROCESSING 200,000 GAL/DAY OF SOUR WATER BY ION EXCHANGE COSTS ABOUT $102,000 AND PROCESSING COSTS ARE FROM $0.07 TO $0.81/1,000 GAL.

00947. WATER TREATMENT FOR REACTORS.

RYAN, L.F.; BROWN, R.M.
POWER ENG., 73, 36-39 JAN. 1969.

POWDERED ION-EXCHANGE RESIN SYSTEMS CAN BE USED TO TREAT WATER FOR APPRECIABLY LOWER COST THAN CAN CONVENTIONAL MIXED-BED UNITS.

00948. WORLD'S LARGEST MICROSTRAINER AT CHICAGO.

WATER & SEWAGE WORKS, 116, 395, OCT. 1969.,

A 15-MGD, FINE-MESH, ROTARY STRAINER FOR A TREATMENT PLANT COST $227,632, INSTALLED.

00949. AN OPTIMAL METER MAINTENANCE PROGRAM FOR THE WAUKESHA WATER UTILITY.

KURANZ, J.H.
WATER & WASTES ENG., 6, 60-63 MAY 1969.

ANNUAL METERING COSTS ARE SHOWN FOR THE YEARS 1948-1963.

00950. COMPLETION OF THE FAIRFAX COUNTY WATER AUTHORITY ACQUISTION PROGRAM.

CORBALIS, J.J. JR.
J AM. WATER WORKS ASSOC., 61, 139-144, MARCH 1969.

A BREAKDOWN OF COSTS FOR A WATER SYSTEM IS GIVEN AND WATER SERVICE CHARGES IN SEVERAL COMMUNITIES ARE SHOWN.

00951. CONTINUOUS DEMINERALIZING FOR BOILER FEED.

THORBORG, C.,.
POWER, 113, 76, 79, JUNE, 1969.

A COST COMPARISON IS SHOWN FOR CONTINUOUS ION-EXCHANGE AND FIXED-BED SYSTEMSFOR DEMINERALIZING 440 GPM OF WATER. CAPITAL COSTS ARE $380,000 AND $525,000 FORTHE TWO SYSTEMS, RESPECTIVELY; AND DAILY CHEMICAL COSTS ARE $956 AND $638.

00952. COOLING LAKES CAN BE A PLEASANT SOLUTION.

EICHER, G. J.
ELECTRIC WORLD, 171, 90-928 APRIL 14, 1969.

COOLING LAKES CAN PROVIDE AN ECONOMICAL SOLUTION TO WATER COOLING PROBLEMS AND, AT THE SAME TIME, CREATE DESIRABLE RECREATIONAL AREAS. CAPITAL COSTS IN $/KW ARE GIVEN FOR COOLING TOWERS AND COOLING LAKES.

00953. COOPERATIVE CITY-COUNTY RATE STRUCTURES.

BADGER, W.A.; ROSE, J.C.
JOUR AWWA, 61, 581-584, NOV. 1969.

WATER RATE, SCHEDULES, MINIMUM CHARGES, AND SYSTEM CONNECTION CHARGES ARE GIVEN FOR THE BALTIMORE COUNTY METROPOLITAN DISTRICT.

00954. DETROIT DEVELOPS WATER SUPPLY FROM LAKE HURON.

REMUS, G.J.
WATER & WASTES ENG., 6, 40-42. APRIL 1969.

COSTS ARE GIVEN FOR THE $140-MILLION PROJECT.

00955. ECONOMIC EVALUATION OF WATER SUPPLY PRICING IN ILLINOIS.

AFIFI, H.H.
JOUR. AWWA, 61, 41-48, JAN. 1969.

COSTS OF WATER ARE GIVEN FOR PRIVATE AND PUBLIC WATERS FOR POPULATIONS OF DIFFERENT SIZES.

REFERENCE LIST

00956. FIELD USE OF A CATIONIC POLYMER FOR CLARIFICATION.

KLEBER, J.P.
WATER & WASTES ENG., 6, 42-44, JUNE 1969.

THE USE OF CATIONIC ORGANIC POLYMERS FOR WATER CLARIFICATION CAN REDUCE TREATMENT COSTS, AS SHOWN.

00957. IMPROVED WATER QUALITY.

MATTSON, R.J.; TOMSIC, V.J.
CHEM. ENG. PROGR., 65, 62-68, JAN. 1969.

CAPITAL AND OPERATING COSTS FOR 100,000 AND 1,000,000 GAL/DAY REVERSE OSMOSIS WATER PURIFICATION PLANTS ARE GIVEN. FOR THE TWO PLANTS, CAPITAL COSTS ARE $155,000 AND $1,000,000, RESPECTIVELY, AND OPERATING COSTS ARE $0.75/1,000 GAL. AND $0.58/1,000 GAL..

00958. STABILIZATION OF AN ACTIVATED SLUDGE PLANT.

WRIGHT, C.D.
WATER & WASTES ENG., 6, 34-36, JUNE 1969.

AN ACTIVATED SLUDGE PLANT OF 4.5-MGD MAXIMUM CAPACITY WOULD COST ABOUT $2-4 MILLION TODAY.

00959. STANLE, N.C., PLANT TREATS MUNICIPAL AND INDUSTRIAL WASTES.

WATER & WASTES ENG., 6, 62, SEPT. 1969.

A 3 (MAX.) MGD WASTEWATER TREATMENT PLANT WAS BUILT FOR $461,186..

00960. TREATMENT PLANT WASTE DISPOSAL IN VIRGINIA.

SUTHERLAND, E. R.
JOUR. AWWA, 61, 187-189, APRIL 1969.

THICKENED SLUDGE SUITABLE FOR LANDFILL CAN BE OBTAINED FOR FROM 0.1 CENTS/1,000 GAL. OF RAW WATER PORCESSED IN A 32-MGD PLANT TO 2.6 CENTS/1,000 GAL. IN A 1-MGD PLANT. CAPITAL COSTS FOR THE TWO INSTALLATION ARE $4,700/MGD AND $20,000 MGD, RESPECTIVELY. VACUUM FILTRATION CAPITAL COSTS ARE $2,800/MGD AND $64,000/MGD FOR 32-MGD AND 1-MGD PLANTS, RESPECTIVELY. OPERATING COSTS ARE 2-2.8 CENTS/1,000 GAL..

00961. WATER RECLAMATION, PHYSICAL AND CHEMICAL METHODS: A LITERATURE REVIEW.

COHEN, J.M.
J WATER POLLUTION CONTROL FED., 41, 978-993, JUNE 1969.

A TERTIARY TREATMENT PLANT CAN REMOVE PHOSPHATE, NITROGEN, AND ORGANICS FROM WATER FOR $0.15/1,000 GAL. A CARBON ADSORPTION PLANT COSTS $0.08/1,000 GAL. TO OPERATE. A PLANT FOR RENOVATING SECONDARY WASTEWATER EFFLUENTS HAD PROCESS COSTS OF $0.18/1,000 GAL.

00962. ABSORPTION AND FILTRATION WITH GRANULAR ACTIVATED CARBON.

HAGER, D.G.
WATER & WASTES ENG. 6, 39-43, AUG. 1969.

COST OF REGENERATING 2,500 LB/DAY OF ACTIVATED CARBON IS $0.015/LB.

00963. AERATION OF STREAMS WITH AIR AND MOLECULAR OXYGEN.

AMBERG, H.R.; WISE, D.W.; ASPITARTE, T.R.
TAPPI, 2, 1866-1871, OCT. 1969.

OXYGEN AND POWER COSTS ARE GIVEN FOR THESE METHODS OF ADDING OXYGEN TO WATER.

00964. PHOSPHORUS REMOVAL: THE STATE OF THE ART.

J WATER POLLUTION CONTROL FED., 41, 701-713, MAY 1969.

METHODS FOR PHOSPHORUS REMOVAL ARE DISCUSSED. TREATMENT COSTS FOR DIFFERENT PROCESSES ARE ESTIMATED AT FROM $0.01 TO $10.15/1,000 GAL..

00965. PRESSING AND INCINERATION OF KRAFT MILL, PRIMARY CLARIFIER SLUDGE.

STOVALL, J.H.; BERRY, D.A.
TAPPI, 52, 2093-2097, NOV. 1969.

A 60-TON/DAY SYSTEM FOR REMOVING, PRESSING AND BURNING KRAFT PULP AND PAPER MILL WASTE SLUDGE COSTS ABOUT $200,000-$300,000 INCLUDING FINAL SLUDGE DISPOSAL IN BARK BOILERS. OPERATING COSTS ARE $2-$10/TON OF SLUDGE HANDLED. OPERATION OF CENTRIFUGES COSTS $6-$9/TON, AND VACUUM FILTERS, $6-$10/TON, BASED ON MOISTURE-FREE SOLIDS..

00966. SECONDARY TREATMENT WITH GRANULAR ACTIVATED CARBON.

RIZZO, J. L.; SCHADE, R. E.
WATER & SEWAGE WORKS, 116, 307-312, AUG. 1969.

OPERATING COSTS FOR THE ADSORPTION PORTION OF THE CLARIFIFCATION/CARBON PROCESS ARE ESTIMATED AT $0.03/1,000 GAL. FOR A 10-MGD PLANT..

00967. SLUDGE/BOD RATIO IS KEY TO WASTEWATER CLEANUP.

CHEM. ENG., 76, 60-62, APRIL 21, 1969.

A $1.7 MILLION BIOLOGICAL TREATMENT SYSTEMS OF THE PETR/TEX CHEMICAL CORP. REMOVE BOD FOR $0.82/LB.

00968. SPRAY IRRIGATION OF FERMENTATION WASTES.

WOODLEY, R. A.
WATER & WASTES ENG., 6, B14-B18, MARCH 1969.

EQUIPMENT FOR SPRAY IRRIGATION COSTS UP TO $1,000/ACRE; LAND COSTS $200-$1,000/ACRE.

COST ANALYSIS OF WATER POLLUTION CONTROL

00969. ALTERNATIVE FOR INDUSTRIAL TREATMENT.

CAMIN, K.Q.
WATER & SEWAGE WORKS, 116, IW/8-IW/13, JULY 1969.

AN INDUSTRIAL FIRM HAS SEVERAL ALTERNATIVES COURSES OF ACTION FOR HANDLING ITS WASTE POLLUTION PROBLEM: (1) HAVE ALL WASTES TREATED IN MUNICIPAL PLANTS, (2) TREAT OWN WASTES, (3) PARTIALLY TREAT OWN WASTES, FOLLOWED BY MUNICIPAL TREATMENT, (4)ALTER MANUFACTURING PROCESS. THE ALTERNATIVES ARE ANALYZED; AND COSTS OF DIFFERENT TREATMENT FACILITIES ARE GIVEN.

00970. CENTRALIZED WASTE-DISPOSAL FACILITY IS ECONOMICAL.

FAATZ, JR, A. C.
OIL & GAS J., 67, 142-144, AUG. 1969.

COSTS ARE GIVEN FOR TRANSPORTING LIQUID AND SOLID WASTES BY TRUCK AND BY BARGE.

00971. CLEAR WATER AND ULTIMATE DISPOSAL.

SEBASTIAN, F.; SHERWOOD, R.
WATER & SEWAGE WORKS, 116, 297-300, AUG. 1969.

COSTS OF SLUDGE VACUUM FILTRATION, INCINERATION AND DISPOSAL PER TON OF SOLIDS ARE GIVEN, FOR THE PERIOD 1939-1965, FOR THE SOUTH TAHOE PHOSPHATE REMOVAL AND WATER RECLAMATION PLANT..

00972. COST ACCOUNTING FOR POLLUTION CONTROL.

FORBES, M.C.
HYDROCARBON PROCESSING, 48, 145-148, OCT. 1969.

THE PHILOSOPHY AND PRINCIPLES OF COST ALLOCATION FOR POLLUTION CONTROL ARE PRESENTED. AN EXAMPLE IS GIVEN..

00973. DEGRADATION OF WASTEWATER ORGANICS IN SOIL.

THOMAS, R. E.; BENDIXON, T.W.
J WATER POLLUTION CONTROL FED., 41, 808-814, MAY, 1969.

LAND DISPOSAL OF LIQUID IS ECONOMICALLY COMPETITIVE WITH OTHER DISPOSAL METHODS. SLUDGE TREATMENT INCLUDING DRYING COSTS ABOUT $35/TON. LAND DISPOSAL OF LIQIUD SLUDGE WOULD REDUCE DISPOSAL COSTS TO $10/TON. THE COST OF MAKING TOPSOIL WITH SLUDGE IS $1,600/ACRE. THE COMPARABLE COST OF IMPROVEMENT WITH NATURAL TOPSOIL IS $4,500/ACRE.

00974. DEEP WELL DISPOSAL PAYS OFF AT CELANESE CHEMICAL PLANT.

VEIR, B.B.
WATER & SEWAGE WORKS, 116, IW/21-IW/24, MAY 1969.

AN ECONOMIC COMPARISON SHOWS THAT CAPITAL COSTS FOR A DEEP WELL SYSTEM ARE HIGHER THAN FOR A BIOLOGICAL SYSTEM, BUT OPERATING COSTS ARE MUCH LOWER

00975. INCINERATOR PAYS FOR ITSELF BY PROVIDING FOR PLANT HEATING.

WATER & SEWAGE WORKS, 116, IW/28-IW/31, SEPT. 1969.

A WASTES INCINERATOR SYSTEM COST $102,000. IT CUT PLANT HEATING COSTS BY $14,400/YR.

00976. INDUSTRIAL WASTES; PAPER AND ALLIED PRODUCTS.

GOVE, G.W.
J WATER POLLUTION CONTROL FED., 41, 1135-1157, JUNE 1969.

A FOAM FRACTIONATION FOR PAPERMILL EFFLUENT TREATMENT IS ESTIMATED AT $20,000 TO $245,000 FOR PLANTS FROM 1 MGD TO 10 MGD. ANNUAL OPERATING COSTS ARE $12,000 TO $88,000. TREATMENT PLANTS COULD PRODUCE USABLE WATER FROM SOME EFFLUENTS FOR $0.145/1,000 GAL., BUT TO PRODUCE USABLE WATER FROM BLEACHED KRAFT EFFLUENT WOULD ADD ABOUT $0.25/1,000 GAL. TO THE COST. A 2.5 MGD CARBON ADSORPTION PLANT WOULD HAVE ANNUAL COSTS OF ABOUT $0.23/1,000 GAL. VARIOUS OTHER CAPITAL AND OPERATING COSTS FOR WATER TREATMENT ARE GIVEN..

00977. MICHIGAN PROFESSOR UNVEILS WASTE TREATMENT PROCESS.

ENG. NEWS-RECORD, 183, 50, OCT. 30, 1969.

A PHYSICOCHEMICAL WASTE TREATMENT PROCESS CLAIMED TO REMOVE 97% OF ORGANIC WASTE MATTER AND MOST OF PHOSPHATES AND NITRATE FROM SEWAGE FOR $0.16 /1,000 GAL.

00978. NEW YORK'S HUDSON RIVER BEND COMPREHENSIVE SEWAGE STUDY.

VONIC, M.; BUMSTEAD, J.C.
J WATER POLLUTION CONTROL FED., 41, 553-567, APRIL 1969.

CONSTRICTION AND ANNUAL COSTS FOR 32.5 MGD AND 6.4 MGD WASTE-TREATMENT PLANTS ARE SHOWN.

00979. BRACKISH WATER TREATMENT.

SCHMIDT, K.A.
POWER ENG., 73, 51-52, MAY 1969.

COST OF PROCESSED BRACKISH WATER IN IOWA IS $0.77-$1.11/1,000 GAL. PUMPING AND DISTRIBUTION COSTS IN VARIOUS TOWNS VARIED FROM $0.30 TO $0.60/1,000 GAL.

00980. ECONOMIC FRAMEWORK FOR SALINITY CONTROL PROJECTS.

COFFEY, P.J.; ORTOLANO, L.
JOUR. AWWA, 61, 237-241, MAY 1969.

A THEORETICAL PLANNING FRAMEWORK HAS BEEN CONSTRUCTED WHICH MAXIMIZES NET ECONOMIC BENEFITS OF SALINITY CONTROL AND INDICATES A CRITICAL LEVEL OF WATER QUALITY ASSOCIATED WITH THAT GOAL.

REFERENCE LIST

00981. ST. THOMAS DESALTING POWER PLANT PRODUCES 2.5 MGD WATER.

TIDBALL, R.A.
WATER & WASTES ENG., 6, 28-30, JUNE 1969.

WATER IS PRODUCED FOR $0.78/1,000 GAL.

00982. SUCCESSFUL LARGE-SCALE DESALTING.

WRIGHT, J.B.
POWER ENG., 73, 46-49, JULY 1969.

A SINGLE-UNIT, 50-STAGE, FLASH EVAPORATOR DESALTING PLANT AT KEY WEST PRODUCES 2.62 MGD OF FRESH WATER AT A COST OF $0.845/1,000 GAL. TOTAL CONSTRUCTION COST WAS $3,584,000; AND TOTAL PLANT COST, INCLUDING LAND, FINANCING CHARGES, AND ARCHITECT-ENGINEER SERVICES WAS $4,056,700.

00983. USSR DESALTING STUDY.

ENG. NEWS-RECORD, 183, 16, JULY 24, 1969.

A PROCESS BASED ON FREEZING IS EXPECTED TO PRODUCE WATER FOR 41.5c/1,000 GAL., COMPARED TO 22.1c-32.5c FOR WATER FROM CONVENTIONAL SOURCES.

00984. WATER DESALTING PRESENT AND FUTURE.

ELIASSEN, R.
JOUR. AWWA, 61, 572-574, NOV. 1969.

A 100-MGD ELECTRODIALYSIS PLANT WOULD DESALT FROM 2,500 TO 500 MG/l FOR ABOUT $0.23/1,000 GAL. ; AND FROM 4,000 TO 500 MG/l FOR ABOUT $0.29/1,000 GAL. A COST COMPARION FOR 150-MGD MULTISTAGE DESALTING PLANTS USING FOSSIL AND NUCLEAR FUELS IS GIVEN. COST OF WATER PER 1,000 GAL. IS ESTIMATED AT $0.685 FOR THE FOSSIL-FUEL PLANT, AND $0.626 FOR THE NUCLEAR PLANT.

00985. HOW MUCH WILL THAT COST PER YEAR.

GRUMMAN, D.L.
ACHV, 66, 36-68, JULY 1969.

COMMON METHODS FOR DETERMINING THE TRUE ANNUAL COSTS OF ALTERNATIVE SCHEMES HAVING DIFFERENT INITIAL AND OPERATING COSTS INCLUDE: EQUIVALENT ANNUAL COSTS; PRESENT WORTH; AND PAYBACK PERIOD. THESE ARE ILLUSTRATED BY A COST COMPARISON OF ROOFTOP AIR CONDITIONING UNITS VS. CONVENTIONAL UNITS.

00986. INVESTMENT RETURN VIA THE ENGINEER'S METHOD.

CHILTON, T. H.
CHEM. ENG. PROGR., 65, 29-34, JULY 1959.

THE RETURN-ON-INVESTMENT METHODS FOR COMPARING ALTERNATIVE INVESTMENT ARE ILLUSTRATED BY A NUMBER OF EXAMPLES.

00987. MORRISVILLE, PA., BUILDS A NEW FILTRATION PLANT.

SALVATORELLI, J.J.
WATER & WASTES ENG., 7, 40-42, JULY 1970.

COST BREAKDOWN AND INVENTORY FOR $1.47-MILLION, 3-MGD FILTRATION PLANT.

00988. NEW BRIGHTON, PA., ACQUIRES 1-MGD WATER PLANT.

WAYNE, M.A.
WATER & WASTES ENG., 32-34, JULY 1970.

BREAKDOWN OF COSTS FOR A 6-MGD, $2.4-MILLION WATER FILTRATION PLANT.

00989. NEW WATERWORKS INTAKE FOR HAMILTON, ONTARIO.

TREDGETT, R.G.; FISHER, D.R.
WATER & WASTES ENG., 7, 32-34, FEB. 1970.

COST BREAKDOWN FOR $2 MILLION 96' DIAM. WATERWORKS INTAKE FOR HAMILTON, ONT.

00990. OPPORTUNITIES FOR WATER SALVAGE.

MYERS, L.E.
CIVIL ENG., 40, 41-44, JAN. 1970.

COST OF INDUSTRIAL AND MUNICIPAL WATER IS $0.25-$0.35/1,000 GAL. COSTS OF WATER SALVAGED BY VARIOUS METHODS ARE GIVEN.

00991. PROCESS COOLING SYSTEM: SYSTEM COSTS SAY OPTIMIZE COOLING.

NICCOLI, L.G.; JASKE, R.T.; WITT, P.A.
HYDROCARBON PROCESSING, 49, 97-108, SECTION 1, OCT. 1970.

WATER-HANDLING CAPITAL AND OPERATING COSTS ARE GIVEN FOR A 100,000-BPSD REFINERY.

00992. REEVALUATION OF PRADO WATER QUALITY OBJECTIVES.

BAIER, D.C.
JOUR. AWWA, 62, 106-112, FEB. 1970.

IN ORANGE COUNTY, CALIF., SOFTENING WATER IN HOME REGENERATED WATER SOFTENERS COSTS $95/ACRE-FT. THE COST DUE TO SHORTENED LIFE OF HOUSEHOLD FACILITIES AS THE RESULT OF SALINITY IS GIVEN IN TERMS OF ANNUAL COST PER HOUSEHOLD.

00993. SYSTEM OPTIMIZATION FOR RIVER BASIN WATER QUALITY MANAGEMENT.

SHIH, C.S.
J WATER POLLUTION CONTROL FED., 42, 1791-1804, OCT. 1970.

AN OPTIMIZATION MODEL FOR RIVER-BASIN WATER-QUALITY MANAGEMENT, BASED ON THE MATHEMATICAL PRINCIPLES OF DYNAMIC PROGRAMMING IS PRESENTED AND COSTS ARE GIVEN.

00994. WATER.

BROOKE, M.
CHEM. ENG., 77, 135-138, DEC 1970.

FROM 1,060 TO 1,600 GAL. /MIN. OF CIRCULATING WATER ARE REQUIRED FOR EACH $1-MILLION OF CAPITAL INVESTMENT IN THE CHEMICAL PROCESS INDUSTRY. TYPICAL CAPITAL INVESTMENT AND OPERATING COSTS ARE GIVEN FOR WATER-TREATMENT FACILITIES.

00995. WATER FOR THE WEST.

GIANELLI, W. R.
JOUR. AWWA, 62, 241-244, APRIL 1970.

COLORADO RIVER WATER FLOWING THROUGH THE COLORADO RIVER AQUEDUCTS COSTS THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA $0.10/1,000 GAL. WATER FROM THE STATE WATER PROJECT OF CALIFORNIA, WHICH WILL BE COMPLETED IN 1972, WILL COST 0.15/1,000 GAL. A PROPOSED DESALTING PLANT AT BOLSA ISLAND WILL PROVIDE WATER FOR ABOUT $0.37/1,000 GAL..

00996. WATER POLLUTION CONTROL: BASIC TECHNIQUES.

CHEM. ENG., 77, 63-70, APRIL 27, 1970.

BASIC POLLUTION CONTROL METHODS ARE DISCUSSED. COOLING TOWERS CAN BE USED TO ELIMINATE THERMAL POLLUTION. COSTS OF TOWERS ARE GIVEN AS A FUNCTION OF WATER FLOW AND COOLING RANGE.

00997. WATER QUALITY PLANNING IN THE PRESENCE OF INTERACTING POLLUTANTS.

DYSART, B.C. III.
J WATER POLLUTION CONTROL FED., 42, 1515, 1970.

THE AUTHOR DEVELOPS AND DEMONSTRATES METHODOLOGY FOR WATER QUALITY PLANNING AND MANAGEMENT WHERE THERE COULD BE SIGNIFICANT INTERACTION OF POLLUTANTS IN THE STREAM. SYSTEM COSTS ARE GIVEN.

00998. COST SAVING IN STEEL PICKLING AND MINERAL PROCESSING.

THE COST ENGINEER BRIT., 9, 1, JULY 1970.

COSTS OF DESCALING STEEL WITH SULFURIC AND HYDROCHLORIC ACIDS.

00999. BUILDING RELIABILITY OF PLANT, PEOPLE, AND SERVICE.

REMUS, G.
JOUR. AWWA, 62, 38-40, JAN. 1970.

CAPACITIES AND COSTS ARE GIVEN FOR DETROIT'S WATER-TREATMENT PLANTS; AND A BREAKDOWN OF WATER REVENUE DOLLAR DISTRIBUTION IN 1957 AND 1967 IS GIVEN.

01000. CARRY SAVES $ WITH NATURAL GAS ENGINE.

BROWN, R.W.; LEINEN, L.M.
WATER & SEWAGE WORKS, 117, 169-170, MAY 1970.

A $4,000 NATURAL-GAS ENGINE, TO DRIVE A PUMP FOR A WATER SYSTEM IS EXPECTED TO SAVE $150,000 OVER A 20-YEAR PERIOD, AS SHOWN BY A COST ANALYSIS.

01001. COMPUTER AIDS IN CRAG WATER PLAN.

CLARK, L.K., KLEIN, A.M.; HARRISON, C.H.
WATER & WASTES ENG., 7, 49-51, APRIL 1970.

A COMPUTERIZED ECONOMIC ANALYSIS WAS USED TO HELP FORMULATE A LONG-RANGE REGIONAL WATER PLAN IN OREGON AND WASHINGTON. COSTS OF WATER FROM VARIOUS SOURCES ARE GIVEN.

01002. COST OF PROVIDING WATER FOR PROTECTION.

COTE, D.R.; GOODMAN, A.S.
JOUR. AWWA, 62, 407-411, JULY 1970.

TOTAL COST OF PROVIDING WATER FOR FIRE PROTECTION WAS STUDIED FOR THREE COMMUNITIES OF 57,000, 55,000, AND 7,000 POPULATION. PER CAPITA COST VARIED FROM $21.50 TO $9.50.

01003. DISTRIBUTION SYSTEM LEAKAGE SURVEY.

CAMPBELL, F. C.
JOUR. AWWA, 62, 401-402, JULY 1970.

A LEAKAGE OF LESS THAN 3,000-GPD PER MILE OF WATER PIPELINE WOULD COST MORE TO LOCATE AND REPAIR THAN IT WOULD BE WORTH. A COST STUDY OF LEAKAGE AND LEAKAGE SURVEY AND REPAIR IS PRESENTED.

01004. ELECTRODIALYSIS OF ESTUARINE WATER.

FULTON, G.P.
JOUR. AWWA, 62, 549-554, SEPT. 1970.

CAPITAL AND ANNUAL COSTS ARE GIVEN FOR WATER TREATMENT BY ELECTRODIALYSIS AND FOR TRANSPORTING THE WATER 35, 50, AND 75 MILES.

01005. EMERGENCY SURGE CONTROL SYSTEM.

SWEENEY, G.; FRANK, J.A.
WATER & SEWAGE WORKS, 117, 390-395, NOV. 1970.

COSTS OF A 60-MGD WATER PUMPING STATION AND DISTRIBUTION SYSTEM ARE GIVEN.

01006. GENEVA, N.Y., IMPROVES WATER TREATMENT PLANT.

SMITH, R.J.
WATER & WASTES ENG., 7, 38-39, JULY 1970.

COST BREAKDOWN AND EQUIPMENT INVENTORY FOR A SYSTEM UTILIZING SLOW SAND FILTERS WITH MICROSTRAINERS AND DIATOMITE FILTERS.

01007. MORE WATER FOR GREENSBORO, NORTH CAROLINA.

PAPP, R.A.
WATER & SEWAGE WORK. 117, 370-372, NOV. 1970.

BREAKDOWN OF COSTS FOR A RESERVOIR, DAM, AND FILTER PLANT IS GIVEN. TOTAL COST OF PROJECT WAS $7,935,580.

01008. THE SELECTION OF GRANULAR VERSUS POWDERED ACTIVATED CARBON.

HYNDSHAW, A.Y.
WATER & WASTES ENG., 7, 49-53, FEB. 1970.

FOR SOME WATER-TREATMENT PLANTS GRANULAR CARBON IS MORE ECONOMICAL THAN POWDERED CARBON FOR TASTE AND ODOR CONTROL, WHILE IN OTHER PLANTS THE REVERSE IS TRUE. CARBON LEVELS, COST OF CARBON, AND REGENERATION COSTS ARE GIVEN.

REFERENCE LIST

01009. THE USE OF FLYASH IN WASTEWATER TREATMENT AND SLUDGE CONDITIONING.

EYE, J.D.; BASU, T. K.
J WATER POLLUTION CONTROL FED., 42, R124-R135, PART 2, MAY 1970.

FLYASH CAN BE USED AS AN ADSORBENT FOR REMOVING MANY IMPURITIES FROM WASTEWATER. IN AN EXAMPLE PRESENTED, COST OF FLYASH IS $950/YR, COMPARED TO $4,175/YR FOR CONDITIONING WITH LIME AND FERRIC CHLORIDE.

01010. UNIQUE DUAL LAGOON SYSTEM SOLVES DIFFICULT WINE WASTE TREATMENT PROBLEM.

TOFFLEMIRE, T.J.; SMITH, S.E. ; TAYLOR, C.W.; RICE, A.C.; HARTSIG, A.L.
WATER & WASTES ENG., 7, F2-F5, NOV. 1970.

INVESTMENT AND OPERATING COSTS ARE GIVEN FOR A PLANT THAT REDUCES BOD CONCENTRATION 96% AND BOD POUNDAGE 99.3%.

01011. WASTE DISPOSAL IN THE MEAT INDUSTRY–PART 1.

STEFFAN, A. J.
WATER & WASTES ENG., 7, B20-B22, MARCH 1970.

CAPITAL AND ANNUAL COSTS ARE GIVEN FOR TRICKLING FILTER, ANAEROBIC CONTACT, AND ANAEROBIC-AEROBIC LAGOON SYSTEMS AS A FUNCTION OF CAPACITY.

01012. WASTEWATER TREATMENT PLANT IN PLANT CITY, FLA.

WALKER, R. E.
WATER & WASTES ENG., 7, A22-A23, JAN. 1970.

A BREAKDOWN OF COSTS FOR A $1-MILLION MUNICIPAL WASTE-TREATMENT PLANT.

01013. WATER-POLLUTION CONCLAVE AIRS NEW TREATMENT SCHEMES.

CHEM. ENG., 77, 40-42, SEPT. 7, 1970.

ANIMAL FOOD CAN BE PREPARED FROM THE SLUDGE RESULTING FROM BIOLOGICAL TREATMENT OF RAW SEWAGE. PRODUCTION COSTS ARE ABOUT 0.015¢/LB.

01014. CHARGES FOR TREATING INDUSTRIAL WASTEWATER IN MUNICIPAL PLANTS.

MAYSTRE, Y.; GEYER, J.C.
J WATER POLLUTION CONTROL FED., 42, 1277-1291, JULY 1970.

SURCHARGES FOR TREATING INDUSTRIAL WASTEWATER IN MUNICIPAL PLANTS IN A NUMBER OF CITIES ARE GIVEN.

01015. COLDWATER CREEK WASTEWATER TREATMENT PLANT.

LARSON, J.W.
WATER & WASTES ENG., 7, 44-48, APRIL 1970.

AN ACTIVATED SLUDGE PLANT COST $5,691,360. DESIGN CRITERIA AND A BREAKDOWN OF COSTS ARE GIVEN.

01016. FLORIDA FIRM USES GAMMA RAYS TO POLISH SEWAGE PLANT EFFLUENT.

ENG. NEWS-RECORD, 185, 24-25, AUG. 13, 1970.

A $90,000 PLANT, DESIGNED FOR TREATING 10,000 GPD, USES 60,000 RADS OF GAMMA RAYS FROM COBALT 60 TO TREAT EFFLUENT FROM SECONDARY TREATMENT. THE COST–$3.30 PR HOUSEHOLD–IS CONSIDERED COMPETITIVE WITH COSTS OF CONVENTIONAL TREATMENT METHODS.

01017. HEAVY METALS IN DIGESTERS: FAILURE AND CURE.

REGAN, T.M.; PETERS, M.M.
J WATER POLLUTION CONTROL FED., 42, 1832-1839, OCT 1970.

HEAVY METALS CAUSED FAILURE OF DIGESTERS IN A SEWAGE SYSTEM. THE TREATMENT AND ITS COST ARE PRESENTED.

01018. IMPROVING BIOLOGICAL PROCESSES.

KNOWLES, JR., C. L.
CHEM. ENG., 77, 108-109, APRIL 27, 1970.

AN INDUSTRIAL WASTE-TREATMENT PLANT DESIGNED FOR 2 MGD AND $1,000 MG/LB OF BOD COSTS ABOUT $3 MILLION. FLUID-BED SLUDGE INCINERATION COST $15-$25/TON OF DRY SOLIDS (0.3-0.5 CENTS/LB BOD DESTROYED).

01019. INCORPORATING INDUSTRIAL WASTES IN SOLUBLE MEDIA.

BLANCO, R.E.; GODBEE, H.W.; FREDERICK, E.J.
CHEM. ENG. PROGR., 66, 51-56, FEB. 1970.

INCORPORATING RADIOACTIVE WASTES IN ASPHALT FOR BURIAL IN LANDFILLS IS A POSSIBLE WASTE-DISPOSAL METHOD. CAPITAL AND OPERATING COSTS FOR A SEWAGE-ASPHALT PLANT ARE GIVEN.

01020. INFILTRATION IN SEPARATE SANITARY SEWERS.

RIDDLE, W. G.
J WATER POLLUTION CONTROL FED., 42, 1676-1683, SEPT 1970.

RESULTS OF A TWO YEAR SURVEY IN THE MATTER OF ELIMINATING INFILTRATION AND STORMWATER IN SEWAGE SYSTEMS IN WESTERN MISSOURI AND EASTERN KANSAS ARE REPORTED. A QUESTIONNAIRE WAS MAILED TO APPROXIMATELY 50 POLLUTION ABATEMENT FACILITY MANAGERS AND 49 REPLIED. LOCATION OF STORM WATER INLETS IS MADE BY A COMPREHENSIVE, ECONOMICAL SMOKE TESTING PROGRAM WHICH ALLOWS VISUAL IDENTIFICATION OF CONTRIBUTING ROOF LEADERS, STREET INLETS, BROKEN PIPES, RUPTURED MANHOLES AND YARD, DRIVEWAY OR AREA-WAY DRAINS. INFILTRATION AND ITS CORRECTION ARE SEPARATE PROBLEMS. VISUAL OBSERVATION IS PRACTICABLE ONLY BY TELEVISION OR PHOTOGRAPHY; HOWEVER, A RECENT DEVELOPMENT WHICH IS RECEIVING CONSIDERABLE AND FAVORABLE ATTENTION IS LOW PRESSURE AIR TESTING. ONCE THE EXACT OR GENERAL LOCATION AND CHARACTER OF INFILTRATION HAS BEEN DETERMINED THE EFFECTS MAY BE CORRECTED IN ONE OF THE FOLLOWING WAYS: (1) EXCAVATION AND REPLACEMENT OR REPAIR, (2) LOCALIZED PRESSURE GROUTING FROM WITHIN, (3) GENERALIZED LOW PRESSURE SEALING FROM WITHIN, (4) LINING TO A REDUCED DIAMETER, (5) PRESSURE GROUTING FROM WITHOUT. COSTS FOR THE VARIOUS METHODS ARE

PRESENTED. THE SUPPLIER OF SEALING CHEMICAL CLAIMS SEALING EFFICIENCIES RANGE FROM 70 TO 95%. COSTS OF TREATING AN 8 INCH SEWER RANGED FROM 80 CENTS TO A $1.00 A FOOT PLUS THE COST OF CHEMICAL. IT IS CONCLUDED THAT THERE IS NO SATISFACTORY REPAIR OR MAINTAINANCE SUBSTITUTE FOR HIGH QUALITY INITIAL CONSTRUCTION. (W71-01852).

01021. NEW ACTIVATED SLUDGE PLANT FOR KNOXVILLE, TENNESSEE.

HILL, K.V.
WATER & WASTES ENG. 7, 32-34, JAN. 1970.

DESIGN DATA AND COSTS FOR A $2.5 MILLION ACTIVATED SLUDGE PLANT.

01022. NUCLEAR-WASTES DISPOSAL: FORMING SOLIDS SAVE SPACE.

LOHSE, G.E.; MODROW, R.D.; WHEELER, B.R.
CHEM. ENG., 77, 94-96, FEB. 1970.

A NUCLEAR-WASTE DISPOSAL PROCESS INVOLVES ATOMIZING FLUID WASTES INTO AN AIRFLUIDIZED BED OF INERT GRANULAR SOLIDS. ANNUAL COSTS FOR A PLANT HANDLING 372,000 GAL. OF ZIRCONIUM WASTE PER YEAR ARE $4.90/GAL. OF WASTE.

01023. O2 (OXYGEN) & O3 (OZONE) RX FOR POLLUTION.

CHEM. ENG., 77, 46-48, FEB. 23, 1970.

OXYGEN AND OZONE WASTE-WATER TREATMENT PROCESSES MAY PROVIDE AN ECONOMICAL ANSWER TO INDUSTRIAL AND MUNICIPAL WASTE-STREAM PROBLEMS. CAPITAL INVESTMENT IS $1,080,000 FOR AN OZONE-TREATMENT PLANT WITHOUT CLARIFICATION AND $2,270,000 WITH CLARIFICATION, FOR A 10 MILLION-GAL. /DAY PLANT; AND OPERATING COSTS ARE 7.7 CENTS/1,000 GAL. AND 15.8 CENTS/1,000 GAL., RESPECTIVELY.

01024. OCEAN DUMPING POSES GROWING PROBLEM.

CHEM ENG. NEWS, 48, 40-41, NOV. 30, 1970.

LARGE QUANTITIES OF WASTES ARE DUMPED IN THE SEA. DISPOSAL COSTS RANGE FROM $0.40/TON FOR DREDGE SPOILS TO $24/TON FOR CONTAINERIZED INDUSTRIAL WASTES. INDUSTRIAL WASTES IN BULK SHIPMENT COST AN AVERAGE OF $1.70/TON.

01025. OIL SKIMMER BELTS HELP CONTROL WATER POLLUTION.

WASTE & SEWAGE WORKS, 117, IW/2-IW/11, NOV. 1970.

IT COST $0.226/1,000 GAL. OF WASTES TREATED FOR CHEMICALS AND DISPOSAL OF TREATMENT BY-PRODUCTS.

01026. OIL SPILLS-WHERE WE ARE AND WHERE WE'RE GOING.

BACHMAN, W. A.
OIL & GAS JOURNAL, 68, 91-98, JUNE 1, 1970.

EFFECTIVENESS AND COST OF VARIOUS OIL-SPILL CONTROL SYSTEMS ARE GIVEN.

01027. OPTIMUM WASTE TREATMENT PLANT DESIGN UNDER UNCERTAINTY.

BERTHOUEX, P.M.; POLKOWSKI, L.B.
J WATER POLLUTION CONTROL FED., 42, 1588-1613, SEPT 1970.

EQUATIONS ARE PRESENTED FOR ESTIMATING COSTS OF CLARIFIERS, AERATION BASINS, DIGESTERS, BLOWERSAND SLUDGE PUMPS. CONSTRUCTION AND OPERATING COSTS ARE GIVEN FOR DIFFERENT CONDITIONS.

01028. PLANNING OF MUNICIPAL WASTEWATER RENOVATION PROJECTS.

PORTER, J.W.
JOUR. AWWA, 62, 543-548, SEPT. 1970.

COST OF WASTEWATER TREATMENT PER 1,000 GAL. ARE GIVEN FOR PLANTS OF VARIOUS CAPACITIES AND FOR DIFFERENT TYPES OF TREATMENT.

01029. PREFABRICATED DUAL LIFT STATION.

WRIGHT, C.D.; LILJEGREN, G.J.
WATER AND WASTES ENG., 7, 64-66, SEPT. 1970.

A SEWAGE LIFT STATION WITH FOUR 8" PUMPS, RATED AT 4.5 MGD, COST $150,000.

01030. PRETREATMENT OF WASTES FOR DISCHARGE TO CITY SYSTEM.

ANDERSON, J.S.; BERGSTROM, R. G.
WATER & WASTES ENG., 7, D1-D4, JULY, 1970.

COSTS ARE GIVEN FOR A SYSTEM HANDLING A MIXTURE OF RAW WASTEWATERS AND INDUSTRIAL WASTES.

01031. PRIMARY TREATMENT PLANT IN THE WYOMING VALLEY.

WATER & SEWAGE WORKS, 117, OCT. 1970.

A 40-MGD PRIMARY SEWAGE TREATMENT PLANT COST $27-MILLION, AND ANNUAL COSTS ARE $530,000.

01032. PURE OXYGEN CUTS COST OF SEWAGE TREATMENT.

ENG. NEWS-RECORD, 184, MARCH 26, 1970.

IT IS ESTIMATED THAT A 100-MGD PLANT USING CONVENTIONAL AIR WOULD COST $6.1 MILLION WHILE A COMPARABLE PLANT USING OXYGEN WOULD COST $4.95 MILLION. OPERATION AND MAINTENANCE WOULD BE $632,000 FOR THE CONVENTIONAL PLANT, AND $283,000 FOR THE OXYGEN PLANT PER YR. COST PER 1,000 GAL. WOULD DROP FROM 8 CENTS TO 5.5 CENTS.

01033. SOLID WASTE DISPOSAL.

BOWERMAN, F. R.
CHEM. ENG., 77, 147-151, APRIL 27, 1970.

COSTS PER 1,000 GAL. ARE GIVEN FOR ULTIMATE WASTE DISPOSAL IN THE FORM OF LIQUID, SLUDGE, AND ASH.

REFERENCE LIST

01034. ACTIVATED CARBON AIDS WATER TREATMENT.

EWING, R.C.
OIL & GAS J., 68, 134-135, MAY 4, 1970.

TOTAL OPERATING COST FOR A 10-MMG/D TERTIARY WASTEWATER TREATMENT PLANT USING ACTIVATED CARBON IS 12.62 CENTS/1,000 GAL.

01035. ACTIVATED CARBON BIDS FOR WASTEWATER TREATMENT JOBS.

BROWNING, J, E,.
CHEM, ENG., 77, 32-34, SEPT. 7, 1970.

ACTIVATED-CARBON ADSORPTION BIOLOGICAL WASTEWATER TREATMENT CAN COMPETE ECONOMICALLY WITH CONVENTIONAL ACTIVATED-SLUDGE SYSTEMS. ACTIVATED-CARBON SYSTEMS CAN PRODUCE PETROLEUM REFINERY EFFLUENTS WITH LESS THAN 20 MG. /LITER BOD AND LESS THAN 10 UNITS OF RECOGNITION ODOR NUMBER. CAPITAL COSTS FOR 1-, 5-, AND 10-MILLION GA. /DAY PLANTS ARE ESTIMATED AT $540,000, $1,390,000, AND $2,300,000, RESPECTIVELY. DIRECT OPERATING COSTS ARE 4.8-10.9 CENTS/1,000 GAL. FOR PRIMARY EFFLUENTS, AND 5.3-9.4 CENTS/1,000 GAL. FOR SECONDARY EFFLUENTS.

01036. ADVANCED WASTEWATER TREATMENT-AN OVERALL SURVEY.

SMITH, C.V.; DIGREGARIO, D.
CHEM. ENG., 77, 71-74, APRIL 27, 1970.

COSTS OF VARIOUS WATER-TREATMENT PROCESSES IN PLANTS FROM 1 TO 100 MGD.

01037. ADVANCED WASTEWATER TREATMENT-REMOVING PHOSPHORUS AND SUSPENDED SOLIDS.

GOODMAN, B.L.; MIKKELSON, K.A.
CHEM. ENG., 77, 75-83, APRIL 27, 1970.

COSTS OF PHOSPHORUS REMOVAL ARE GIVEN FOR SEVERAL PROCESSES.

01038. AN INDUSTRIAL SOLUTION TO INDUSTRIAL POLLUTION.

PARK, W.R.
CONSULTING ENGINEER, 34, 52-58, FEB. 1970.

ANNUAL COSTS FOR BOD REMOVAL AS A FUNCTION OF PERCENT REMOVED; AND OPTIMUM TREATMENT LEVELS AS A FUNCTION OF USE FEES.

01039. ANALYSIS OF TREATMENT PLANT COSTS OFFERS CHECK ON NEW UNIT'S PRICE.

ENG. NEWS-RECORD, 184, 98-105, JUNE 18, 1970.

A SERIES OF COST CURVES AND TABLES FOR ESTIMATING THE COST OF VARIOUS TYPES OF SEWAGE-TREATMENT PLANTS AS A FUNCTION OF CAPACITY, AND PER CAPITA.

01040. HYBRID SCHEME MAY LOWER DESALTING COSTS.

CHEM. ENG. NEWS, 48, 38, APRIL 13, 1970.

STONE AND WEBSTER ENGINEERING CORP. HAS INTRODUCED ITS DUO-CYCLE DESALTING PROCESS, WHICH INVOLVES BOTH FLASH EVAPORATION AND REVERSE OSMOSIS. COSTS OF WATER IN A 131-MILLION-GALLON-PER-DAY PLANT ARE ESTIMATED AT $0.46-$0.56/1,000 GAL..

01041. HYDROCARBON EXTRACTION OF SALINE WATERS.

BARTON, P.; FENSKE, M.R.
IND. ENG. CHEM. PROCESS DES. DEVELOP., 9, 18-25, JAN. 1970.

POTABLE WATER CAN BE PRODUCED FROM SALINE WATERS BY EXTRACTING WITH LIQUID HYDROCARBON AT 650 F. AND 2,600 PSIA. A PLANT TO PRODUCE 10-MILLION GAL. /DAY OF DESALTING WATER IS ESTIMATED TO COST $18-MILLION. OPERATING COSTS ARE $0.99/1,000 GAL.

01042. INDUSTRIAL WASTE DESALTING FOR BYPRODUCT RECOVERY.

BOVET, E.D.
JOUR. AWWA, 62, 539-542, SEPT. 1970.

BESIDES PRODUCING POTABLE WATER, DESALTING TECHNIQUES MAY BE USED TO RECOVER POTENTIALLY VALUABLE BYPRODUCTS FROM EFFLUENTS IN MANY INDUSTRIES.

01043. REVERSE OSMOSIS OFFERS USEFUL TECHNIQUE FOR DESALTING.

CHANNOBASAPPA, K.C.
WATER & WASTES ENG., 7, A5-A8, JAN. 1970.

COSTS OF DISTILLATION AND REVERSE OSMOSIS DESALTING PLANTS ARE GIVEN AS A FUNCTION OF CAPACITY; AND WATER COSTS BY ELECTRODIALYSIS AND REVERSE OSMOSIS. PRESENT COST OF INDUSTRIAL WATER IN THE U. S. IS $0.125-$0.50/1,000 GAL.

01044. SOLAR DESALTING.

DELYANNIS, A.A.; DELYANNIS, E.A.
CHEM. ENG., 77, 136-140 OCT. 19, 1970.

A REVIEW OF SOLAR DESALTING AROUND THE WORLD. COSTS OF SOLAR STILLS ARE $1.0-$1.15/SQ. FT.

01045. ZEROING IN ON DESALTING.

BROWNING, J.E..
CHEM. ENG., 77, 64-66, MARCH 23, 1970.

CAPITAL INVESTMENT FOR DESALTING PLANTS VARIES FROM $0.48 TO $1.74/GAL. PER DAY DEPENDING UPON THE PROCESS AND THE PLANT CAPACITY. WATER COSTS VARY FROM $0.31 TO $0.90/1,000 GAL. DEPENDING UPON SOLIDS CONCENTRATION OF FEEDWATER AND PLANT SIZE..

01046. BY-PRODUCT MARKETS AWAIT DESALTERS.

CHEM. ENG. NEWS, 48, 18-20, JULY 13, 1970.

BYPRODUCT RECOVERY PAYS DESALTING COSTS IN THE FOLLOWING INDUSTRIES: COAL MINING (ACID MINE DRAINAGE), CHEESE AND DAIRY, IRON AND STEEL, NUCLEAR POWER, PLATING AND METAL FINISHING; AND PULP AND PAPER.

01047. IODINE FOR THE DISINFECTION OF WATER.

BLACK, A.P.
JOUR. AWWA, 60, 69-83, JAN. 1968.

THE COST OF IODINATION FOR DISINFECTION IS 1/3 TO 1/2 THAT OF CHLORINATION.

01048. EFFECTS OF HIGHLY MINERALIZED WATER ON HOUSEHOLD PLUMBING AND APPLIANCES.

PATTER, W.L.; BANKER, R.F.
JOUR. AWWA, 60, 1060-1069, SEPT. 1968.

THE AVERAGE HOUSEHOLD HAS AN INVESTMENT OF $1,123 IN WATER AND SEWAGE SYSTEMS AND RELATED EQUIPMENT. THE HARDER THE WATER, THE SHORTER THE SERVICE LIFE AND THE GREATER THE ANNUAL COST..

01049. INJECTION OF TREATED WASTE WATER INTO AQUIFERS.

ROSE, J.L.
WATER & WASTE ENG., 5, 40-43 OCT. 1968.

TREATED WASTE WATERS ARE INJECTED INTO AQUIFERS TO RESTORE GROUND-WATER LEVELS. INVESTMENT AND OPERATING COSTS ARE GIVEN FOR A 10-MGD TREATMENT PLANT.

01050. MICROSTRAINING AND OZONATION OF WATER AND WASTEWATER.

DIAPER, E.W.J.
WATER & WASTES ENG., 5, 56-58, FEB. 1968.

A PLANT FOR TREATING WATER BY MICROSTRAINING AND OZONATION IN LOCH TURRET, SCOTLAND COST $1,436,400. THE ELECTRICAL LOAD IS 377.2 KW.

01051. MIXED-BED CONDENSATE POLISHING.

CRITS, G.J.
POWER ENG., 72, 48-51, MARCH 1968.

MIXED-BED DEMINERALIZERS ARE USED TO TREAT STEAM CONDENSATE IN A POWER PLANT. COST OF OPERATION IS GIVEN.

01052. NEW CONDENSATE POLISHERS RETAIN AMMONIA.

CRITS, G.J.
POWER, 112, 84-87, NOV. 1968.

AMMONIATED MIXED-BED RESIN SYSTEMS ARE EFFECTIVE FOR PURIFYING BOILER CONDENSATES. OPERATING COSTS ARE GIVEN.

01053. NEW PUMPING AND WATER TREATMENT FACILITIES FOR AUGUSTA, MAINE.

WATER & WASTES ENG., 5, 45-50 DEC.1968.

A BREAKDOWN OF COSTS IS GIVEN FOR TWO RECENT PUMPING STATIONS.

01054. TOWNSHIP WATER RATES IN MICHIGAN'S UPPER PENINSULA.

COURCHAINE, C.
WATER & SEWAGE WORKS, 115, 52-156, APRIL 1968.

WATER COSTS VARY FROM $1.25 TO $15.00 PER MONTH. AVERAGE DAILY COST IS $0.10 PER FAMILY.

01055. TRENDS: VENTURA WATER SUPPLY.

OWEN, P.E.
JOUR. AWWA, 60, 1240-1244, NOV. 1968.

MONTHLY MINIMUM METER RATES AND MONTHLY WATER SUPPLY RATES ARE GIVEN FOR VENTURA, CALIF.

01056. WATER UTILITY COST TRENDS.

COHEN. S.L.; NORTH, E.C.; ADELMANN, C.B.
JOUR. AWWA, 60, 129-134 FEB. 1968.

AVERAGE PRICE OF MUNICIPAL WATER IS $0.30/1,000 GAL. ; IRRIGATION WATER COSTS $0.08-$0.12/1,000 GAL. DELIVERED.

01057. TREATMENT OF MINK FOOD MANUFACTURING WASTES.

TORGERSON, G.E.
WATER & SEWAGE WORKS, 115, 535-540, NOV. 1958.

A BREAKDOWN OF COSTS IS GIVEN FOR A WASTE TREATMENT SYSTEM.

01058. WASTEWATER PLANT EFFLUENT CHLORINATION MADE EASY AND INEXPENSIVE.

DOROLEK, R.J.
WATER & WASTES ENG., 5, 48-50, OCT. 1968.

COSTS OF CHLORINATION FACILITIES ARE GIVEN. IN THE CAPACITY RANGE OF 10-30 MGD, COSTS ARE $16,000/MGD..

01059. WASTEWATER RECLAMATION AT SOUTH TAHOE PUBLIC UTILITIES DISTRICT.

CULP, R.L.
JOUR. AWWA, 60, 84-94, JAN. 1968.

CAPITAL AND OPERATING COSTS ARE GIVEN FOR A 7.5-MGD PLANT.

01060. WASTEWATER RECLAMATION PROJECT.

DYE, E.O.
WATER & SEWAGE WORKS, 115, 139-144, APRIL 1968.

THE COST OF A WASTEWATER RECLAMATION PROJECT AT TUCSON, ARIZ. IS GIVEN.

01061. WHAT NEW WATER QUALITY STANDARDS MEAN TO PRODUCTION COSTS.

BRAMER, H.C.
CHEM. ENG. PROGR., 64, 35-69 MARCH 19689.

THE WATER QUALITY ACT OF 1965 WILL RESULT IN THE EXPENDITURE OF LARGE SUMS FOR WASTE TREATMENT. TYPICAL TREATMENT COSTS PER 1,000 GAL.: PRIMARY $0.10; SECONDARY, $0.20; TERTIARY, $0.40.

REFERENCE LIST

01062. A POLICY FOR HYDRANT INSTALLATION.

JACKSON, L.A.
WATER & WASTES ENG., 5, 79-87, MAY 1968.

HYDRANT PURCHASING AND INSTALLATION PRACTICES IN LITTLE ROCK, ARK. THE HYDRANT RENTAL, OR PUBLIC CHARGE, IS $35 PER HYDRANT PER YEAR..

01063. CALIFORNIA PLANT USES DIATOMITE AND CARBON FILTERS.

LAWRENCE, C.H.
WATER & WASTES ENG., 5, 46-49, JAN. 1968.

A BREAKDOWN OF CONSTRUCTION COSTS AND EQUIPMENT INVENTORY FOR A WATER-FILTRATION PLANT IN CALIFORNIA.

01064. CHEMICAL REMOVAL OF PHOSPHORUS FEASIBLE.

CHEM. ENG NEWS, 46, 42-43 FEB. 19, 1968.

COST OF REMOVING 90-95% OF PHOSPORUS FROM MUNICIPAL WASTE WATERS IN A 10-MILLION-GAL. -PER-DAY PLANT IS ESTIMATED TO BE $0.05/1,000 GAL. OR LESS..

01065. EVALUATING WATER QUALITY.

RAMBOW, C.A..
JOUR. AWWA, 60, 10-14, JAN. 1968.

INDUSTRIES USING WATER WITH MORE THAN 100 MG. /LITER OF TOTAL DISSOLVED SOLIDS INCUR COSTS OF ABOUT 4c PER MG/LITER PER ACRE-FOOT; FOR COMMERICAL AND DOMESTIC USE, INCREASED HARDNESS RESULTS IN INCURRED COSTS OF APPROXIMATELY 2.2c PER MG. /LITER HARDNESS PER ACRE-FT.

01066. IMPROVED COOLING WATER TREATMENT.

DONAHUE, J.M.; HALES, W.W.
HYDROCARBON PROCESSING, 47, 101-106, JUNE 1968.

A COMPARISON OF COSTS OF CHROMATE AND NONCHROMATE TREATMENTS TO REDUCE SCALE AND CORROSION..

01067. A REVIEW OF THE LITERATURE IN 1967 ON WASTEWATER AND WATER POLLUTION CONTROL.

WEISS, C.M.
J WATER POLLUTION CONTROL FED., 40, 897-1219, JUNE 1968.

THIS EXTENSIVE REVIEW OF THE LITERATURE CONTAINS A NUMBER OF REFERENCES TO COSTS.

01068. ACTIVATED SLUDGE VS. TRICKLING FILTER PLANTS.

DYE, E.O.
WATER & SEWAGE WORKS, 115, 499-504, NOV. 1968.

OPERATING COSTS OVER A 6-YEAR PERIOD ARE GIVEN FOR SEWAGE PLANTS IN TUCSON, ARIZ.

01069. CAPITAL COSTS OF SEWAGE PLANTS.

KLEI, H.E.; TAMBORRA, J.M.; WOOD, R.T.
WATER & WASTES ENG., 5, 61, APRIL, 1968.

A CHART GIVES THE COST OF ACTIVATED SLUDGE AND TRICKLING FILTER SEWAGE PLANTS FROM 0.1 TO 1,000 MGD.

01070. A NEW RIVAL FOR FLASH DISTILLATION.

POWER, 112, 79, SEPT 1968.

PLANTS TO PRODUCE 1 MILLION GALLONS OF FRESH WATER PER DAY COST AS FOLLOWS: FLASH EVAPORATION, $143,300F VAPOR COMPRESSION, $184,000; FALLING-FILM EVAPORATION, $185,800..

01071. DESALTING 7.5 MGD AT TIJUANA.

STEINBRUCHEL, A.A; BEAGLE, J.
POWER ENG., 72, 5., MARCH 1968.

A DUAL-PURPOSE UNIT, WHICH COUPLES A 300-MW POWER PLANT WITH TWO 3.75 MGD DESALTERS, PRODUCES WATER FOR $0.65/1,000 GAL.

01072. DESALTING SEA WATER WITH AMMONIA.

MURRAY, W.B.
WATER & SEWAGE WORKS, 115, 482-487, OCT. 1968; 525-534, NOV. 1968.

SEA WATER DESALINATION USING AMMONIA CAN BE CARRIED OUT BY ION EXCHANGE OR OSMOSIS. THE SYSTEMS ARE DESCRIBED, AND SOME COSTS ARE GIVEN.

01073. GUIDELINES FOR THE DETERMINATION OF THE FEASIBILITY OF DESALTING SEA WATER.

WILSON, J.R.; CADWALLADER, E.A.
JOURNAL AWWA, 10, 103-108, JAN. 1968.

THIS ARTICLE GIVES PRODUCT WATER CONVEYANCE COSTS, COSTS OF DESALTING PLANTS, UNIT COSTS OF WATER, AND LABOR REQUIREMENTS.

01074. INDUSTRIAL WASTE DISCHARGE APPLICATION: MOCK HEARING.

ROBERTSON, J.H.
J WATER POLLUTION CONTROL FED., 40, PART 1, 805-834, MAY 1968.

AMONG THE COSTS IN THIS REPORT OF THE 40TH ANNUAL CONFERENCE OF THE WATER POLLUTION CONTROL FEDERATION ARE CAPITAL AND OPERATING COSTS FOR VARIOUS DESALINATION PROCESSES.

01075. LOWERING THE COST OF REVERSE-OSMOSIS DESALTING.

MILLER, E.F.
CHEM. ENG., 75, 153-158 NOV. 18, 1968.

DESALINATION OF BRACKISH WATER CAN BE ACCOMPLISHED FOR $0.35-$0.40/1,000 GAL. ; AND A COST OF $0.10-$0.15/1,000 GAL. FOR DESALINATION OF SEAWATER IS FORECAST FOR 300-MILLION GAL. /DAY PLANTS.

01076. MEMBRANES COMPETE FOR SEPARATION MARKETS.

PATTISON, D. A..
CHEM. ENG., 75, 38-42, JUNE 3, 1968.

MEMBRANE-TYPE SEPARATION PROCESSES ARE BECOMING INCREASINGLY IMPORTANT. COSTS OF DESALINATION ARE GIVEN.

01077. NUCLEAR DESALTING FUTURE TRENDS, AND TODAY'S COSTS.

STARMER, R.; LOWES, F.
CHEM, ENG., 75, 127-134, SEPT. 9, 1968.

COSTS ARE GIVEN FOR DESALTING WATER, STEAM AND POWER FROM NUCLEAR PLANTS AND FOSSIL FUEL PLANTS.

01078. RECYCLE BOOSTS DESALTING EFFICIENCY.

WEISMANTEL, G. E.
CHEM. ENG., 75, 86-88, JULY 15, 1968.

THE CLAIR ENGLE FLASH DISTILLATION DESALTING PLANT AT CHULA VISTA, CALIF., PRODUCE 1 MILLION GAL. OF FRESH WATER/DAY USING 1 LB OF STEAM PER 20 LB. WATER. COSTS ARE ABOUT $0.60/1,000 GAL.

01079. SOLAR DISTILLATION IN AUSTRALIA.

MORSE, R.N.
CIVIL ENG., 38, 39-41, AUG. 1968.

WESTERN AUSTRALIA WATER IS SCARCE AND HIGHLY SALINE. SOLAR STILLS CAN BE BUILT FOR $0.50 PER SQ. FT/YR., AND WILL PRODCUE 24 IMPERIAL GAL. /SQ. FT. WATER COSTS ARE ABOUT $3/IMPERIAL GAL.

01080. STACKED DECK SEPARATES SALTS FROM SOLUTION.

CHEM. ENG., 75, 110-111, OCT. 7, 196 .

ELECTRODIALYSIS UNITS ECONOMICALLY TREAT FEEDS CONTAINING 100 TO 15,000 PPM. DISSOLVED SOLIDS. COSTS ARE GIVEN.

01081. SELECTING DEMINERALIZATION SYSTEMS.

ASKEW, A.A.
POWER ENG., 75, 45-47 DEC. 1971.

CAPITAL AND OPERATING COSTS FOR THREE DEMINERALIZATION SYSTEMS OF 900-, 2,000-, AND 2,500-GPM CAPACITY.

01082. SURFACE SUPPLY COSTS MORE, FARM BUREAU SHOWS.

STOLTENBERG, D.H.
WATER & WASTES ENG., 8, 23, FEB. 1971.

AVERAGE OPERATING AND MAINTENANCE COSTS FOR NON-FHA FINANCED RURAL WATER SYSTEMS WERE $2.38/USERS; AND FOR FHA-FINANCED SYSTEMS, $2.74/USER. WELLS WERE CHEAPER THAN SURFACE SUPPLIES.

01083. THE TRUE COST OF WATER.

SPITZER, E.F.
JOUR. AWWA, 63, 325-328, JUNE 1971.

APPROXIMATELY 18% OF WATER UTILITIES IN THE U. S. HAVE HIGH RATES IN ONE OR MORE OF THEIR SERVICE AREAS. MOST RATES ARE IN THE RANGE OF $7.50-$9.00/10,000 GAL. PER MONTH, BUT SOME RATES ARE AS HIGH AS $136.50.

01084. UNIT PRICING CHALLENGES TRADITIONAL BLOCK-RATE METHOD.

BRAMS, M.R.
WATER & WASTES ENG., 88 36-39, NOV. 1971.

A BREAKDOWN OF CAPITAL AND OPERATING COSTS, AND PRICES PER 1,000 GAL FOR WATER SERVICE IN DELAWARE.

01085. WATER RECLAMATION AND REUSE: LITERATURE REVIEW.

KEINATH, T.M.
J WATER POLLUTION CONTROL FED., 43, 1163-1171, JUNE 1971.

COSTS OF RECLAMATION ARE $0.143-$0.16/1,000 GAL FOR 10-MGD PLANTS.

01086. ARTIFICIAL DESTRATIFICATION IN RESERVOIRS.

JOUR. AWWA, 63, 597-604, SEPT. 1971.

INVESTMENT AND OPERATING COSTS ARE GIVEN FOR VARIOUS TYPES OF RESERVIOR MIXING EQUIPMENT.

01087. CONSIDER RO FOR PRODUCING FEEDWATER.

ROWLAND, H.; NUSBAUM, I.
POWER, 115, 47-48 DEC. 1971.

CAPITAL COSTS AND MEMBRANE-REPLACEMENT COSTS ARE GIVEN FOR REVERSE OSMOSIS/DEMINERALIZER SYSTEMS FOR BOILER AND PROCESS WATER, IN CAPACITIES FROM 10 TO 5,000 GPD.

01088. CONTROLS FOR A MEDIUM-SIZED WATER UTILITY.

LEE, R.L.
JOUR. AWWA, 63, 527-529, AUG. 1971.

AUTOMATIC SUPERVISORY CONTROLS FOR THE MEDFORD, ORE. WATER SYSTEM COST $69,000, OR 0.5% OF THE TOTAL SYSTEM INVESTMENT.

01089. DIATOMITE SYSTEM GETS NOD.

STAUFF, J.
WATER & WASTES ENG., 8, 37-39, APRIL 1971.

ESTIMATED COSTS OF 10-MGD WATER-FILTRATION PLANTS WERE: DIATOMITE, $948,800; PRESSURE SAND, $1,459,500; GRAVITY SAND, $1,488,800. CORRESPONDING ESTIMATED TOTAL ANNIAL COSTS PER MILLION GALLONS WERE: $63, $80, AND $82. ACTUALLY, THE DIATOMITE PLANT WAS BUILT FOR $842,000.

REFERENCE LIST

01090. FINANCIAL ASPECTS OF WATER MAIN EXTENSION.

JOUR. AWWA, 63, 669-670, OCT. 1971.

AVERAGE NET INCOME VS. CAPITAL EXPENDITURE FOR PUBLIC-OWNED UTILITIES IS SHOWN.

01091. METROPOLITAN BANGKOK WATER PROJECT.

SULLIVAN. D.E.
JOUR. AWWA, 129-134, FEB. 1971.

WATER NEEDS, WATER SUPPLY CONSTRUCTION COSTS, AND USER RATES ARE ESTIMATED FOR THE NEXT 25-30 YEARS.

01092. NITRATE REMOVAL FROM A GROUND WATER SUPPLY.

HOLZMACHER, R. G.
WATER & SEWAGE WORKS, 118, 210-213, JULY 1971.

AN ION-EXCHANGE PLANT CAPABLE OF REMOVING UP TO 40 MG/L OF NITRATE NITROGEN FROM 4 MGD OF WELL WATER IS ESTIMATED TO COST $405,000. OPERATING COSTS FOR 40 MG/L WATER AND A 40% UTILIZATION FACTOR ARE $0.16/1,000 GAL.

01093. PLATING PLANT CUTS WATER BILL TWO-THIRDS.

WOLFE, J.L.
WATER & WASTES ENG., 8, A18-A20, JAN. 1971.

TREATMENT AND RE-USE OF WASTEWATER SAVED A PLANT $24,000/YR.

01094. QUALITY CONSIDERATIONS IN SUCCESSIVE WATER USE.

LINSTEDT, K.D.; BENNETT, E.R.; WORK, S.W.
J WATER POLLUTION CONTROL FED., 43, 1681-1694, AUG 1971.

THE COST OF POTABLE WATER RENOVATION PER 1,000 GAL IS SHOWN FOR VARIOUS TYPES OF TREATMENT.

01095. RECREATION BENEFITS RATE HIGH.

LAWRENCE, C.H.
WATER & WASTES ENG., 8, 36-39, MARCH 1971.

COSTS OF WATER-TREATMENT FOR 6 MGD NOMINAL FLOW RATE WERE $1,532,000.

01096. RURAL COMMUNITY WATER SUPPLY COSTS.

STOLTENBERG, D.H.
JOUR. AWWA, 63, 287-288, MAY 1971.

PROJECT OPERATION, AND MAINTENANCE COSTS OF FHA-FINANCED RURAL COMMUNITY WATER SYSTEMS IN ILLINOIS; AND USER RATES. AVERAGE MINIMUM BILL IS $9.50 PER USER PER MONTH.

01097. AIR-COOLED HEAT EXCHANGERS-NEW GROWTH.

ELLIOTT, T. C.
POWER 115, 88-90, AUG. 1971.

COOLING-WATER EQUIPMENT COSTS ARE GIVEN FOR THE FOLLOWING SYSTEMS: ONCE-THROUGH, COOLING LAKES, AND EVAPORATIVE AND AIR-COOLED NATURAL- AND MECHANICAL-DRAFT TOWERS.

01098. COOLING WATER.

SILVERSTEIN, R.M.; CURTIS, S.D.
CHEM. ENG., 78, 84-86, AUG. 9, 1971.

TREATING COSTS ARE SHOWN FOR ONCE-THROUGH AND OPEN-CIRCULATING COOLING-WATER SYSTEMS.

01099. DESIGNING OPTIMUM COOLING SYSTEMS.

WIGHAM, I.
CHEM. ENG., 78, 95-102, AUG. 9, 1971.

OPTIMIZATION OF TUBE-AND-SHELL HEAT EXCHANGERS AND COOLING TOWERS IS SHOWN. CAPITAL AND OPERATING COSTS ARE GIVEN.

01100. DRYING COOLING TOWER SHOWS PROMISE.

ELECT. WORLD, 175, 60-61, JUNE 1, 1971.

COOLING-SYSTEM COSTS PER KW FOR 800-MW POWER PLANTS ARE AS FOLLOWS: MECHANICAL DRAFT, $25 FOR FOSSIL-FUELED AND $37 FOR NUCLEAR; NATURAL DRAFT, $26 FOR FOSSIL-FUELED AND $40 FOR NUCLEAR.

01101. DRY-TYPE COOLING SYSTEMS.

ROSSIE, J.P.
CHEM. ENG. PROGR., 67, 58-63, JULY 1971.

CAPITAL COSTS PER KW OF DRY-TYPE COOLING SYSTEMS FOR 800-MW POWER PLANTS ARE: FOSSIL-FUELED PLANTS, $17 AND $20, RESPECTIVELY, FOR MECHANICAL-DRAFT AND NATURAL-DRAFT TOWERS; NUCLEAR POWER PLANTS, $24 AND $27, RESPECTIVELY, FOR MECHANICAL-DRAFT AND NATURAL-DRAFT TOWERS.

01102. MECHANICAL DRAUGHT COOLING TOWER.

KUNESCH, A. M.
THE CHEM. ENGINEER NO. 253, 337-341, SEPT. 1971.

RELATIVE COSTS OF TIMBER AND GLASS-FIBER REINFORCED SHELL TOWERS FOR THE YEARS 1950-1970 ARE SHOWN; AND WATER COSTS IN SEVERAL CITIES IN ENGLAND.

01103. WASTE HEAT DISPOSAL IN POWER PLANTS.

JIMESON, R. M.; ADKINS, G.G.
CHEM. ENG. PROG., 67, 64-69 JULY 1971.

UNIT COSTS, IN $/KW, OF COOLING-WATER SYSTEMS FOR FOSSIL-FUELED AND NUCLEAR-FUELED POWER PLANTS ARE GIVEN FOR THE FOLLOWING TYPES: ONCE-THROUGH, COOLING PONDS, EVAPORATIVE MECHANICAL-DRAFT AND NATURAL-DRAFT COOLING TOWERS, AND NON-EVAPORATIVE MECHANICAL-DRAFT AND NATURAL-DRAFT COOLING TOWERS.

COST ANALYSIS OF WATER POLLUTION CONTROL

01104. WET-SURFACE AIR COOLERS.

KALS, W.
CHEM. ENG., 78, 90-94, JULY 26, 1971.

AN ECONOMIC COMPARISON OF A SHELL-AND-TUBE HEAT EXCHANGER WITH A WET PRIME-SURFACE AIRCOOLER. COSTS AND POWER CONSUMPTION OF THE WET AIR-COOLER ARE LOWER.

01105. OPERATING VS. CAPITAL COSTS: EVALUATING TRADEOFF BENEFITS.

BUEHLER, J.D.; FIGGE, G.J.
CHEM. ENG., 78, 96-102, FEB. 8, 1971.

THE AUTHORS PRESENT A PRESENT VALUE TRADEOFF METHOD FOR RELATING CAPITAL AND OPERATING COSTS. THE METHOD IS ILLUSTRATED BY EXAMPLES INVOLVING COSTS.

01106. QUARTERLY COST ROUNDUPS.

ENG. NEWS-RECORD, 186, MARCH 18, 1971; 186, JUNE 17, 1970; 187, SEPT 16, 1971; DEC. 16, 1971.

INDEXES FOR BUILDINGS, CONSTRUCTION, EQUIPMENT, MACHINERY, LABOR, PUBLIC UTILITIES, PETROLEUM REFINERIES, HIGHWAY, IRRIGATION AND HYDROELECTRIC PLANTS, WATERWORKS, SEWAGE-TREATMENT PLANTS AND SEWER LINES. COST OF OFFICE BUILDINGS, INDUSTRIAL BUILDINGS, SCHOOLS, HIGH-RISE APARTMENTS, PUBLIC HOUSING, RAILROADS, INTEREST ON BONDS AND BUSINESS LOANS, IRON AND STEEL PRODUCTS, LUMBER, TIMBER, PLYWOOD, WINDOW GLASS, EXPLOSIVES, PILES, HIGHWAY TUNNELS, BRIDGES, IRRIGATION LINES, STORM DRAINS, AND CANALS.

01107. SEWAGE TREATMENT PLANT AND SEWER CONSTRUCTION COST INDEX.

JOUR. WATER POLL. CONTROL FED., 43, 1971.

INDEXES BY CITIES, AND NATIONAL AVERAGES, PUBLISHED IN EACH MONTHLY ISSUE.

01108. BAHAMAS ON A SALT-FREE DIET.

HORNBURY, C. D. ; SAARINEN, JR., A.W.
WATER & WASTES ENG., 8, 32-34 AUG 1971.

A 2-MILLION IMPERIAL GAL/DAY DESALINATION PLANT COST $4,323,000. A WATER POWER COMPLEX COST $18,973,000.

01109. CONTROLLED FLASH-EVAPORATION.

ROE, R.C.; OTHMER, D.F.
MECH. ENG., 93, 27-32, MAY 1971; CHEM. ENG. PROGR., 67, 77-79 JULY 1971.

CONTROLLED FLASH EVAPORATION, A VARIANT OF THE MULTISTAGE FLASH-EVAPORATION PROCESS, HAS HIGHER THERMAL EFFICIENCY. WATER COST BY DESALINATION WITH CONVENTIONAL MULTISTAGE FLASH EVAPORATION IS $0.87/1,000 GAL. AT 100 F., CONTROLLED FLASH EVAPORATION WILL PRODUCE WATER FOR $0.10/1,000 GAL LESS THAN FOR THE CONVENTIONAL PROCESS; AND AT 250 F., IT WILL PRODUCE WATER FOR $. 06/1,000 GAL. LESS.

01110. ENGLAND PLANS FIRST FREEZE DESALTING.

CHEM. ENG. NEWS, 49, 57-58 MAY 10, 1971.

A FREEZE-DESALTING PLANT IN ENGLAND IS EXPECTED TO PRODUCE WATER FOR $0.48/1,000 GAL.

01111. HIGH EFFICIENCY DESALTING.

HORNBURG, C.D.
POWER ENG., 75, 56-57, MARCH 1971.

THE FIRST STEP OF A $30-MILLION POWER AND DESALTING PLANT IN NASSAU IS UNDER CONSTRUCTION. WATER AND POWER COSTS ARE EXPECTED TO BE 20% LOWER THAN THE PRESENT 1c KWH AND $1.10/1,000 U. S. GAL.

01112. REVERSE OSMOSIS: HOLLOW FIBERS GET TRYOUTS.

CHOPEY, N.P.
CHEM. ENG., 78, 28-30 FEB. 8, 1971.

HOLLOW-FIBER REVERSE OSMOSIS LOOKS PROMISING FOR DESALTING BRACKISH WATER. A 150,000-GAL/DAY PLANT IS EXPECTED TO OPERATE AT ABOUT $0.45/1,000 GAL. INCLUDING AMORTIZATION.

01113. 63 YEAR-OLD SEWERS UPGRADED.

BRISBIN, S.G.
WATER & WASTES ENG., 8, 47-49 APRIL 1971.

AN ACTIVATED-SLUDGE SEWAGE-TREATMENT PLANT FOR A POPULATION OF 20,000 (AVERAGE FLOW, 3.5 MGD) COST $1,970,000. TOTAL COST OF THE PROJECT, INCLUDING SEWERS, WAS OVER $3-MILLION.

01114. A SPRAY IRRIGATION SYSTEM FOR TREATMENT OF CANNERY WASTES.

GILDE, L.C.; KESTER, A.S.; LAW, J.P.; NEELEY, C.H.; PARMLEE, D.M.
JOUR. WATER POLL. CONTROL FED., 43, 2011-2025, OCT. 1971.

CONSTRUCTION COST WAS $1,007/ACRE, EXCLUSIVE OF LAND COST; AND OPERATING COST WAS $0.052/1,000 GAL.

01115. ACTIVATED CARBON SYSTEM TREATMENT OF COMBINED MUNICIPAL AND PAPER MILL WASTE WARERS IN FITCHBURG, MASS.

RIMER, A. E.; CALLAH, W. F.; WOODWARD, R.L.
TAPPI, 54, 1477-1483, SEPT. 1971.

A 12.5-MGD WASTE-TREATMENT PLANT HAD AN ESTIMATED COST OF $12,270,000, AND OPERATING COSTS FOR THE FIRST YEAR WERE ESTIMATED AT $515,000.

01116. ADSORPTION/FILTRATION PLANT CUTS PHENOLS FROM EFFLUENTS.

HENSHAW, T. B.
CHEM. ENG., 78, 47-49, MAY 31, 1971.

A PLANT USING ACTIVATED CARBON REDUCES TOXIC PHENOLS IN WASTE EFFLUENT FROM 100 TO 1 MG/1. THE 150,000-GAL/DAY PLANT COST $300,000; AND OPERATING COSTS ARE 35.6c/1,000 GAL.

REFERENCE LIST

01117. AERATED LAGOON TREATMENT OF SULFITE PULP AND PAPER MILL EFFLUENTS.

AMBERG, H.R.; ASPITARTE, T. R.; BYINGTON, K.F.; EHLI, J.J.; COMA, J.G.
TAPPI, 54, 1698-1707, OCT. 1971.

CAPITAL COST AND DIRECT AND INDIRECT OPERATING COSTS ARE GIVEN FOR A SECONDARY-TREATMENT PLANT.

01118. AERATED LAGOONS IN SERIES SEEM ANSWER.

WATER & WASTES ENG., 8, E10-E11, SEPT. 1971.

OPERATING COSTS ARE GIVEN FOR AERATED STABILIZATION BASIN TREATMENT OF PAPER MILL EFFLUENTS.

01119. PHOSPHORUS REMOVAL BY LUXURY UPTAKE.

MULBARGER, M.C.; SHIFFLETT, D.G.; MURPHY, M.C.; HUFFMAN, D.D.
J WATER POLLUTION CONTROL FED., 43, 1617-1628, AUG. 1971.

A 1-MGD WASTEWATER-TREATMENT PLANT INVOLVING PHOSPHORUS REMOVAL WAS ESTIMATED TO COST $1,439,000. AND TOTAL TREATMENT COST WAS ESTIMATED AT $0.52/1,000 GAL.

01120. POLYMERS IN THE FILTRATION OF RAW SLUDGE.

HOPKINS, G.J.; JACKSON, R.L.
J WATER POLL. CONTROL FED., 43, 689-698, APRIL 1971.

POLYELECTROLYTES ARE USED AS THE SOLE AGENT FOR CONDITIONING WASTEWATER SLUDGE FOR VACUUM FILTRATION. POLYELECTROLYTE COST IS $2.20/DRY TON OF SOLIDS.

01121. PROCESS EVALUATION-PHOSPHORUS REMOVAL.

GEINOPOLOS, A.; VILEN, F.I.
JOUR. WATER POLL. CONTROL FED., 43, 1975-1990, OCT. 1971.

PHOSPHORUS CONTENTS OF WASTE-TREATMENT EFFLUENTS ARE GIVEN; AND ESTIMATED CAPITAL COSTS FOR PHOSPHORUS-REMOVAL TECHNIQUES, AND COST OF DAILY CHEMICAL REQUIREMENTS.

01122. PURE OXYGEN IMPROVES ACTIVATED SLUDGE PROCESS.

BRIT. CHEM. ENG., 16, 567, 568, JULY 1971.

A CHART SHOWING COSTS OF OXYGENATION AND CONVENTIONAL AIR AERATION SYSTEMS AS A FUNCTION OF PLANT SIZE.

01123. RAGS TO RICHES: THE ECONOMICS OF RECYCLING WASTES.

PARK, W.R.
CONSULTING ENG., 37, 58-62, NOV. 1971.

WASTE-DISPOSAL COSTS, IN $/TON, ARE GIVEN FOR INCINERATION AND SANITARY LANDFILL, AS A FUNCTION OF PLANT CAPACITY; AND THE VALUE OF RECOVERED MATERIALS IS ALSO GIVEN.

01124. SOUR-WATER PROCESSING TURNS PROBLEM INTO PAYOUT.

ANNESSEN, R.J.; GOULD, G.D.
CHEM. ENG., 78, 67-69 MARCH 22, 1971.

CHEVRON RESEARCH CO. HAS DEVELOPED A WASTE-WATER-TREATMENT PROCESS FOR REFINERIES. INVESTMENT AND ANNUAL COSTS ARE GIVEN. PAYOUT TIME IS 0.5-0.8 YEAR.

01125. THE USES OF FILTER PRESSES FOR THE DEWATERING OF SLUDGES.

THOMAS, C.M.
J WATER POLLUTION CONTROL FED., 43, 93-101, JAN 1971.

IN GREAT BRITIAN, AVERAGE CAPITAL COST OF DEWATERING PLANTS USING FILTER PRESSES IS $10.80/LB OF DRY SOLIDS PER DAY ASSUMING ONE CYCLE PER DAY, ALTHOUGH PLANTS CAN OPERATE ON 2 OR 3 CYCLES PER DAY. AVERAGE OPERATING COSTS, INCLUDING SOLIDS DISPOSAL, ARE $17.00/TON. THE ADVANTAGES OF THE FILTER PRESS OVER ALTERNATIVE METHODS ARE SUMMARIZED. THE USE OF THEORY AND LABORATORY EVALUATIONS TO PREDICT FILTER PRESS PERFORMANCE AND OPTIMUM SIZE ARE DISCUSSED. STORAGE TANKS, CHEMICAL CONDITIONING PLANTS, FEED PUMPS, FILTER CLOTHS, AND FILTRATE COLLECTION TRAYS ARE COMMENTED ON. COST AND PERFORMANCE DATA ARE PRESENTED. (EI-40563).

01126. THERMAL SYSTEM KEY TO PURE WATER PROCESS.

POWER, 115, 77-79, JULY 1971.

DESCRIPTION OF THE SOUTH TAHOE WASTEWATER RECLAMATION PLANT, WITH RELATIVE COSTS OF SLUDGE DISPOSAL BY SEVERAL METHODS.

01127. TREATMENT-COST RELATIONSHIPS FOR INDUSTRIAL WASTES.

ECKENFELDER, JR., W.W.; BARNARD, J.L.
CHEM. ENG., PROGR., 67, 76-85, SEPT. 1971.

CAPITAL AND OPERATING COSTS ARE GIVEN FOR VARIOUS TYPES OF WASTE-TREATMENT PLANTS.

01128. UNUSUAL SEWER SYSTEM ELEMENTS AT CHARLESTON, SOUTH CAROLINA.

WALTER, C. R.
JOUR. WATER POLL. CONTROL FED., 43, 1921-1928, SEPT. 1971.

COST OF PUMPING PLANT AND AUXILIARY EQUIPMENT WAS $825,000. COST OF 4,000-FT LONG 60" SEWER LINE WAS $1[illegible]5/FT.

01129. WASTE WATER RECLAMATION IN A CLOSED SYSTEM.

BESIK, F..
WATER & SEWAGE WORKS, 118, 213-219, JULY 1971.

CONSTRUCTION AND TREATMENT COSTS ARE GIVEN FOR VARIOUS TYPES OF WASTEWATER-TREATMENT PLANTS OF 0.1,0.5, AND 1.0 MGD CAPACITY.

COST ANALYSIS OF WATER POLLUTION CONTROL

01130. WASTEWATER TREATMENT: LITERATURE REVIEW.

COHEN, J.M.
J WATER POLLUTION CONTROL FED., 43, 1092-1104, JUNE 1971.

TREATMENT COSTS FOR TERTIARY TREATMENT OF SECONDARY EFFLUENT ARE $0.41, $0.147, AND $0.10/1,000 GAL FOR PLANTS OF 1,10, AND 100 MGD. PHOSPHORUS REMOVAL COSTS $0.05-$0.06/1,000 GAL. DEMINERALIZATION BY OSMOSIS COSTS $0.20-$0.35/1,000 GAL.

01131. WATER POLLUTION CONTROL.

CHEM. ENG., 78, 65-75, JUNE 21, 1971.

A DISCUSSION OF METHODS FOR WASTEWATER TREATMENT. CAPITAL COSTS OF COOLING TOWERS ARE GIVEN, AND THE COST OF THE BIOTA-TRON AERATION AND CLARIFYING SYSTEM FOR TREATMENT OF INDUSTRIAL WASTES. OPERATING COSTS OF PRECOAT FILTERS ARE ALSO GIVEN.

01132. WATER POLLUTION CONTROL AT THE ROHM AND HAAS HOUSTON PLANT.

PARROTT, J.W.; SMITH, W.M.
WATER & SEWAGE WORKS, 118, IW/4-IW/8, JAN. 1971.

CAPITAL AND ANNUAL COSTS OF WASTE-TREATMENT FACILITIES ARE GIVEN. TREATMENT COST-INCLUDING DEPRECIATION-IS $0.77/1,000 GAL.

01133. BIOLOGICAL-CHEMICAL WASTEWATER TREATMENT.

STUKENBERG, J.R.
JOUR. WATER POLL. CONTROL FED., 43, 1791-1806, SEPT. 1971.

CONSTRUCTION AND OPERATING COSTS ARE GIVEN FOR VARIOUS TYPES OF 10-MGD WASTE-WATER-TREATMENT PLANTS.

01134. CHICAGO INDUSTRIAL SURCHARGE ORDINANCE.

ANDERSON, N.E.; SASEWITZ, B.
JOUR. WATER POLL. CONTROL FED., 43, 1591-1599, AUG. 1971.

CAPITAL AND UNIT COSTS ARE GIVEN FOR SEWER SYSTEMS AND WASTEWATER-TREATMENT PLANTS. COST OF SLUDGE DISPOSAL IS APPROXIMATELY $40/TON.

01135. CHICAGO SHIPS ITS SLUDGE TO THE FARMLAND.

ENG. NEWS-RECORD, 186, 22-23 FEB. 4, 1971.

TO HEAT-DRY SLUDGE COSTS $50/TON; TO TRANSPORT IT 160 MILES AND SPRAY IT ON FARMLAND COSTS $43/TON OF DRY SOLIDS.

01136. CONTROL OF WASTEWATER TREATMENT PLANTS-THE ENGINEER AS OPERATOR.

ANDREWS, J.F.
WATER & SEWAGE WORKS, 118, 26-32, JAN. 1971

A 10-MGD ACTIVATED-SLUDGE PLANT WITH 87.5% BOD REMOVAL COSTS $22 MILLION, AND TOTAL TREATMENT COST IS 5.05 CENTS/LB BOD REMOVED. IF BOD REMOVAL IS INCREASED TO 92.5%, CAPITAL COSTS INCREASE BY $2,200,000, BUT BOD REMOVAL COST PER LB REMAINS THE SAME.

01137. DEEP-WELL INJECTION OF WASTEWATER.

TAFFLEMIRE, T.J.; BREZNER, G.P.
J WATER POLLUTION CONTROL FED., 43, 1468-1479, JULY 1971.

A 3,000-FT DEEP INJECTION SYSTEM COSTS $200,000-$300,000.

01138. DISPOSAL OF HYDROUS SLUDGES FROM A PAPER MILL.

BISHOP, F.W.; DREW, A.E.
TAPPI, 54, 1830-1831, NOV. 1971.

IT COST ABOUT $20/TON TO DISPOSE OF 26 TON/DAY OF SLUDGE.

01139. DISPOSAL OF SOLID WASTES.

WITT, JR., P.A.
CHEM. ENG., 78, 62-78, OCT. 4, 1971.

EQUIPMENT AND OPERATING COSTS FOR DISPOSAL OF WASTES BY LANDFILL, MARINE DISPOSAL, AND INCINERATION.

01140. EMULSION BREAKING SOLVES OILY-WASTE DISPOSAL.

OIL & GAS J., 69, 76-77, NOV. 22, 1971.

AT A REFINERY WASTES WERE GENERATED AT A RATE OF 5,600 BBL/WEEK, AND HAULING COSTS WERE $0.60/BBL. A RECOVERY SYSTEM SAVED $173,000 PER YEAR IN HAULING COSTS, AND ADDED $375,000/YR TO THE NET VALUE OF THE REFINERY OPERATIONS..

01141. EUTROPHICATION-LITERATURE REVIEW.

FOEHRENBACH, J.
J WATER POLLUTION CONTROL FED., 43, 1191-1202, JUNE 1971.

OPERATING AND CHEMICAL COSTS FOR 90% PHOSPHORUS REMOVAL ARE $32/MILLION GAL WITH JUST COAGULATION; AND $50/MILLION GAL WITH SAND FILTRATION AND 97% BOD REMOVAL..

01142. FILTER PLANT INCLUDED WASTE TREATMENT.

JOHN, R.L.
WATER & SEWAGE WORKS, 118, 96-98 APRIL 1971.

A 6-MGD PLANT COST $2.4-MILLION.

01143. HANDLING OF SOLID WASTES.

ALBERTSON, O.E.; VAUGHN, D.R.
CHEM. ENG. PROGR., 67, 49-54, SEPT. 1971.

DEWATERING OF SLUDGES WITH CENTRIFUGALS. SOME COSTS ARE GIVEN.

REFERENCE LIST

01144. JOB CORPS BUILDS RECREATION PARK SEWAGE LAGOON.

WRIGHT, D.D.
WATER & SEWAGE WORKS, 118, 21-22, JAN 1971.

A 3-ACRE LAGOON WAS CONSTRUCTED TO ACCOMODATE WASTEWATER FROM A POPULATION OF 7,000 PEOPLE. A BREAKDOWN OF COSTS IS GIVEN.

01145. LAGOONS AND OXIDATION PONDS: LITERATURE REVIEW.

BOYLE, W.C.
J WATER POLLUTION CONTROL FED., 43, 1118-1129, JUNE 1971.

WASTEWATER FROM FOOD PROCESSING PLANTS ARE TREATED IN AERATED LAGOON FOR $0.04-$0.067/LB BOD REMOVAL.

01146. MASSIVE WASTE LOAD ELIMINATED BY DRUG HOUSE.

ELLS, R.H.
WATER & WASTES ENG., 8, A26-A28, JAN. 1971.

WASTES FROM A PHARMACEUTICAL PLANT WERE ELIMINATED FROM WASTEWATER BY MEANS OF A $3.89-MILLION PLANT. OPERATING COSTS ARE $1,582,000/YR.

01147. MERCURY REMOVED FROM WASTE EFFLUENT VIA ION EXCHANGE.

GARDINER, W.C.; MUNOZ, F.
CHEM. ENG. 78, 57-59, AUG. 1971.

INSTALLED COSTS OF MERCURY-REMOVAL UNITS TO HANDLE BOTH LIQUID AND SOLID WASTES FROM 300-AND 600-TON/DAY CHLOR-ALKALI PLANTS ARE $400,000 AND $575,000, RESPECTIVELY, INCLUDING LICENSING FEE. OPERATING COSTS ARE GIVEN.

01148. METROPOLITAN SEWER DISTRICT OF GREATER CINCINNATI PROGRAM.

COSTER, A.D.
J WATER POLLUTION CONTROL FED., 43, 372-380, MARCH 1971.

SEWER CHARGES FOR DIFFERENT TYPES OF ESTABLISHMENTS ARE GIVEN; AND A BREAKDOWN OF THE DEPT. OF SEWERS BUDGET.

01149. MICROSTRAINING OF COMBINED SEWER OVERFLOWS.

DIAPER, E.W.J.; GLOVER, G.E
J WATER POLLUTION CONTROL FED., 43, 2101-2113, OCT. 1971.

CAPITAL AND OPERATING COSTS ARE GIVEN FOR VARIOUS COMBINED SEWER OVERFLOW TREATMENT SCHEMES AND FACILITIES.

01150. MICROSTRAINING PAPER MILL WASTEWATER.

RIMER, A.E..
J WATER POLLUTION CONTROL FED., 43, 1528-1540, JULY 1971.

THE ESTIMATED COST OF A WASTEWATER-TREATMENT PLANT INVOLVING MICROSTRAINING IS $644,000, FOR A MAXIMUM CAPACITY OF 2.5 MGD. ANNUAL COST FOR FIRST-YEAR OPERATION IS ESTIMATED AT $32,500 FOR AVERAGE FLOW OF 0.74 MGD.

01151. MUNICIPAL WASTEWATER TREATMENT BY PHYSICAL AND CHEMICAL MEANS.

VILLIERS, R.V.; BERG, E.L.; BRUNNER, C.A; MASSE, A.N.
WATER & SEWAGE WORKS, 118, R62-R81, AUG. 1971.

ESTIMATED CAPITAL AND OPERATING COSTS ARE GIVEN FOR 1-MGD, 10-MGD, AND 100-MGD LIME CLARIFICATION AND CARBON ABSORPTOON MUNICIPAL WATEWATER-TREATMENT PLANTS, AND 10-MGD CONVENTIONAL ACTIVATED-SLUDGE-TREATMENT PLANT WITH SLUDGE DISPOSAL BY THICKENING, FILTRATION, AND INCINERATION.

01152. NEW ION-EXCHANGE SYSTEM TREATS SOUR WATER.

OIL & GAS J., 69, 88-89, FEB. 22, 1971.

EQUIPMENT, RESIN, AND PROCESSING COSTS ARE GIVEN FOR A 200,000-GAL/DAY SOUR-WATER TREATING PLANT. CAPITAL INVESTMENT IS $102,000. PROCESSING COSTS VARY FROM $0.07/1,000 GAL USING WASTE HSO AND NOH AND NO PHENOL TREATMENT, TO $0.81/1,000 GAL USING FRESH HSO AND NAOH AND WITH PHENOL TREATMENT.

01153. NEW PROCESS TREATS ACID RINSE WATERS.

MELZER, S.F.; TAULKIN, T.L.
WATER & WASTES ENG., 8, F6, F8, NOV. 1971.

CAPITAL COSTS ARE $1,360,000 FOR A 550-1,000 GPM PLANT. OPERATING COSTS, EXCLUSIVE OF SUPERVISION AND SLUDGE DISPOSAL, ARE $0.24/1,000 GAL.

01154. NEW WASTEWATER TREATMENT PROCESSES.

SWANSON. C.L.
CIVIL ENG., 41, 49-54, SEPT. 1971.

CAPITAL AND ANNUAL COSTS ARE GIVEN FOR SEVERAL SEWAGE-TREATMENT PROCESSES.

01155. NITRIFICATION AND DENITRIFICATION IN ACTIVATED SLUDGE SYSTEMS.

MULBARGER, M.C.
JOUR. WATER POLL. CONTROL FED., 43, 2059-2070, OCT. 1971.

A COMPARISON OF CAPITAL COSTS ON A 10-MGD BASIS ARE SHOWN.

01156. NUCLEAR WASTE HEAT TO TREAT MUNICIPAL SEWAGE.

WATER & WASTES ENG., 8 46-48, NOV. 1971.

WASTE HEAT FROM A PROPOSED NUCLEAR PLANT COULD BE USED TO COMPLETELY TREAT A MAJOR PART OF RHODE ISLAND'S MUNICIPAL SEWAGE IN A $74-MILLION SYSTEM.

01157. OCEAN POLLUTION AND MARINE WASTE DISPOSAL.

CHEM. ENG., 78, 60-66, FEB. 1971.

PROBLEMS ASSOCIATED WITH THE DUMPING OF WASTES IN THE OCEAN. COSTS ARE GIVEN FOR HAULING AND DUMPING VARIOUS TYPES OF WASTES IN THE ATLANTIC AND PACIFIC OCEANS AND THE GULF OF MEXICO.

01158. OPTIMIZE SOLIDS CONTROL.

LINSTEDT, K.D.; COHEN, D.B.
WATER & WASTES ENG., 8, 46-48, MAY 1971.

CENTRIFUGE CONTROL, BY INCREASING SLUDGE CONCENTRATION, CUT CHEMICAL AND DISPOSAL COSTS FROM $32.75/TON DRY SOLIDS TO $25.20.

01159. OZONE: THE COMING TREATMENT.

MCNABNEY, R.; WYNNE, J.
WATER & WASTES ENG., 8, 46-48, AUG. 1971.

OZONATION IS THE LIKELY TERTIARY SEWAGE-TREATMENT PROCESS OF THE FUTURE. CAPITAL AND OPERATING COSTS ARE GIVEN FOR 1-, 10-, AND 100-MGD PLANTS.

01160. METHODOLOGICAL ASPECTS OF TECHNICO-ECONOMIC PARAMETERS OF NUCLEAR DESALINATION PLANTS.

LOGINOV, A.A.; CHERNYAEV, V.A.
DESALINATION 7(3), 323-342, 1970.

THE REVIEW AND ANALYSIS IS GIVEN OF THE EXISTING METHODS OF APPORTIONING THE PRODUCTION COSTS AT A COMBINED PLANT, PRODUCING ELECTRICITY AND HEAT. THE FORMULATED GENERALIZED METHOD AND THE METHODOLOGY OUTLINED ARE BASED ON THE ECONOMIC CATEGORY OF 'EVALUATED EXPENDITURE', COSTING COMPUTATIONS AND COMPARISON CRITERIA FOR ECONOMIC FEASIBILITY AND DISTRIBUTION OF TOTAL EVALUATED EXPENDITURE, METHODS OF DISTRIBUTION OF TOTAL PRODUCTION EXPENDITURE AND DETERMINATION OF COST OF ELECTRICITY, HEAT AND DISTILLATE. (EI-54043).

01161. USING WASTE WATER TO CUT POLLUTION CONTROL COSTS.

RIES, K.M.
MATER PROT 9(3), 13-15, 1970.

THIS PAPER POINTS OUT THE POTENTIAL NECESSITY OF WASTE WATER REUSE AS A MEANS OF CURBING POLLUTION CONTROL COSTS. COOLING WATER HAS ONE OF THE GREATEST POTENTIALS AS BEING AN EFFECTIVE USE FOR WASTE WATERS. FACTORS THAT MUST BE KNOWN IN ORDER TO MAKE A PARTICULAR WATER SUITABLE FOR COOLING PURPOSES ARE DISCUSSED, AND EXAMPLES OF SUCCESSFUL INSTALLATIONS ARE PRESENTED. (EI-45602).

01162. INFLUENCE OF RAW WATER CHARACTERISTICS ON MEETING REQUIREMENTS FOR QUALITY WATER.

HARTUNG, H.O.; TUEPKER, J.L.
SANITARY ENG CONFERENCE, 11TH-PROC FEB 5-6 1969 P 43-53.

EXAMINES THE IMPORTANCE OF SOME OF THE DISSOLVED MATERIALS IN RAW WATER THAT WILL AFFECT THE PRODUCTION OF A QUALITY WATER AND THE IMPORTANCE OF IDENTIFYING DISSOLVED SUBSTANCES IN WATER. SOME QUESTIONS REGARDING THE CHOICE OF A SOURCE OF WATER SUPPLY ARE EXAMINED. THE IMPORTANCE OF A QUALITY WATER SOURCE IS EMPHASIZED FOR THE PRODUCTION OF A QUALITY POTABLE WATER AT AN ACCEPTABLE COST TO THE COMMUNITY. (EI-17573).

01163. INFLUENCE OF TOXIC MATERIALS ON MEETING THE REQUIREMENTS FOR QUALITY WATER.

WOODWARD, R.L.
ILLINOIS, UNIV-COLLEGE OF ENG-SANITARY ENG CONFERENCE, 11TH-PROC FEB 5-6 1969 P 37-9.

IT IS STATED THAT IN GENERAL, CONVENTIONAL WATER TREATMENT PROCESSES ARE NOT VERY EFFICIENT IN REMOVING OR DESTROYING TOXIC MATERIALS ALTHOUGH CHLORINATION AND ACTIVATED CARBON ARE EFFECTIVE IN DEALING WITH SOME MATERIALS. AVOIDANCE OF THE PROBLEM BY CHOOSING HIGH QUALITY RAW WATERS OR BY POLLUTION PREVENTION WILL PROBABLY BE MORE ECONOMICAL THAN PROVIDING SPECIALIZED TREATMENT PROCESSES. (EI-17574)

01164. INFLUENCE OF WATER USER REQUIREMENTS ON RELATIVE IMPORTANCE OF RAW WATER CHARACTERISTICS.

SONNEN, M.B.
SANITARY ENG CONFERENCE, 11TH, PROC., P 119-36, FEB. 5-6, 1969.

ANALYTICAL PROCEDURES HAVE BEEN DEVELOPED FOR AIDING THE SELECTION OF WATER TREATMENT PROCESSES. DEPENDING ON WHETHER OR NOT THE WATER USERS' QUALITY DESIRES ARE TO BE GUARANTEED SATISFACTION FROM THE START. LEAST-COST SOLUTIONS ARE DISCUSSED FOR THE GUARANTEED-SATISFACTION OF USERS' REQUIREMENTS. THE ANALOGY IS DRAWN BETWEEN WATER TREATMENT DECISION ANALYTICS AND THOSE FOR THE WASTEWATER TREATMENT SELECTION CASE. (EI-17712).

01165. CAN VE HELP SOLVE THIS PROBLEM.

SHUPE, R.
J VALUE ENG, 70(1), 12-15, 1970.

IT IS PROPOSED THAT VALUE ENGINEERING CAN BE APPLIED TO ENVIRONMENTAL POLLUTION AND PERHAPS OTHER ECOLOGICAL PROBLEMS AS WELL. THE SCOPE OF THE PROBLEMS IN AIR AND WATER POLLUTION CONTROL, PARTICULARLY FOR INDUSTRIAL PLANTS, IS OUTLINED. TWO RECOMMENDED APPROACHES ARE FINDING BY-PRODUCT USES FOR INDUSTRIAL WASTES, AND THE DEVELOPMENT OF NEW MANUFACTURING PROCESSES. (EI-46202).

01166. WATER RESOURCES SYSTEMS ANALYSIS.

CHOW, V.T.; MEREDITH, D.D.
HYDRAULIC ENG SER 19, JULY 1969, 80 P.

ANNOTATED BIBLIOGRAPHY ON STOCHASTIC PROCESSES IS REVIEWED FOR APPLICATION OF THE THEORY OF STOCHASTIC PROCESSES IN HYDROLOGY AND TO DEVELOP A PRACTICAL PROCEDURE BY WHICH THE STOCHASTIC BEHAVIOR OF THE HYDROLOGIC CHARACTERISTICS OF A HYDROLOGIC SYSTEM IS TO BE ADEQUATELY SIMULATED MATHEMATICALLY. HYDROLOGIC DATA SERVE AS AN INPUT TO THE WATER RESOURCES SYSTEM. REVIEW INCLUDES 260 ANNOTATED BIBLIOGRAPHIC REFERENCES. (EI-19658).

REFERENCE LIST

01167. OLD PLANTS REVIVED WITH NEW CONTROL CENTER.

MARGON, J.M.; NEIDHART, J.F.
CHEM ENG, 76(15), 115-1120, 1969.

SUCCESS IN CONVERTING AN OLD PLANT FROM SEVERAL INDIVIDUAL CONTROL CENTERS TO CENTRALIZED CONTROL DEPENDS ON ADOPTING NEW AND DIFFERENT CONCEPTS IN THE DESIGN OF CONTROL CENTERS AND ON ABANDONING SOME OLD ONES. WHAT CONCEPTS ARE INVOLVED, HOW THE CHANGE CAN BE MADE SYSTEMATICALLY AND ECONOMICALLY, AND WHAT BENEFITS WILL BE GAINED ARE DISCUSSED IN THIS ARTICLE. (EI-54106).

01168. DESIGN METHOD FOR SOUR WATER STEAM STRIPPERS.

WALKER, G.J.
NAT PETROLEUM REFINERS ASSN TECH PAPER, AM-69-35 FOR MEETING SAN ANTONIO, TEX, MAR 23-29, 1969, 18 P.

FROM COMMERCIAL OPERATIONS, A METHOD HAS BEEN DEVELOPED FOR DESIGN OF REFLUXED AND NONREFLUXED SOUR WATER STEAM STRIPPERS. STUDY INDICATES THAT WHEN A CHOICE BETWEEN REFLUXING AND NOT REFLUXING IS POSSIBLE, A NONREFLUXED STRIPPER SHOULD BE USED. INVESTMENT AND OPERATING COSTS ARE LOWER, PHENOL REMOVAL IS HIGHER, AND OVERHEAD SYSTEM PROBLEMS ARE MINIMIZED. (EI-21034).

01169. PROFITS FROM POLLUTANTS.

MALIM, T.H.
IRON AGE, 204(18), 93-96, 1969.

OPINION IS EXPRESSED THAT INDUSTRY IS ON THE THRESHOLD OF CHANGE IN ATTITUDE ABOUT WASTE TREATMENT; GREAT COST OF WASTE TREATMENT WILL PROMPT REEVALUATION OF CONVENTIONAL METHODS AND FACILITIES; ONE WAY WOULD BE TO SEE WHERE WASTES CAN BE REUSED TO RECOVER AT LEAST PART OF COST. PETROCHEMICAL INDUSTRY IS WELL AHEAD OF METALS INDUSTRY, AS STATED BY ONE OFFICIAL AND EXAMPLES ARE GIVEN; USE OF SPENT HYDROCHLORIC ACID PICKLE LIQUOR, FINE DUSTS OF BOF'S, OPEN HEARTHS AND ELECTRIC FURNACES AND OTHER WASTE PRODUCTS OF STEEL INDUSTRY. (EI-07937).

01170. TRICKLING FILTER MODEL. DESIGN AND COST FACTORS.

ROESLER, J.F.; SMITH, R.
INDUS WATER ENG, 6(9), 46-49, 1969.

THE MATHEMATICAL MODEL OF THE TRICKLING FILTER FINAL SETTLING PROCESS DESCRIBED CONSTITUTES A SINGLE SUBROUTINE IN A COMPUTER PROGRAM INVOLVING THE PRELIMINARY DESIGN OF WASTEWATER TREATMENT SYSTEMS. THE SUBROUTINE SPECIFICALLY COMPUTES THE RELATIONSHIP OF THE VARIOUS PHYSICAL PROPERTIES OF THE TRICKLING FILTER, BOD REMOVAL EFFICIENCIES, AND COSTS. THE LATTER INCLUDES CAPITAL, OPERATING, AND MAINTENANCE COSTS FOR TRICKLING FILTER, FINAL SETTLER, AND RETURN PUMPS. THE PRINCIPAL WATER CONTAMINANT REMOVED BY THE TRICKLING FILTER IS 5-DAY BOD. (EI-45860).

01171. PLASTIC RELINING OF SMALL DIAMETER PIPES.

BREMNER, R.M.
ASCE, J SANIT ENG DIV., 96(SA2), PAPER 7216, 297-317, 1970.

NEW METHOD DESCRIBED INVOLVES THE INSERTION OF A HIGH DENSITY PLASTIC PIPE THROUGH THE OLD SEWER, THE EXTENSION OF ALL LIVE DRAINS INTO THE NEW PLASTIC PIPE AND THE GROUTING OF THE ANNUALAR SPACE BETWEEN THE LINER AND THE OLD SEWER. THE METHOD IS CARRIED OUT WITH A MINIMUM AMOUNT OF EXCAVATION AND DISTURBANCE TO THE TRAVEL PORTION OF THE ROADWAY. IT IS SHOWN TO BE LESS EXPENSIVE AND THREE TIMES FASTER THAN THE CONVENTIONAL OPEN CUT METHODS. IT RESTORES THE PHYSICAL CONDITION OF OLD SEWERS AND IMPROVES THEIR HYDRAULIC CAPACITY. (EI-47194).

01172. AQUEDUCT CONTROL SYSTEMS SAVES 100 MILLION DOLLARS.

GOLZE, A.R.
POWER ENG, 73(10), 30-35, 1969.

COMPUTER BASED REMOTE CONTROL SYSTEM AND NEW CONTROLLED VOLUME CONCEPT SAVE 100 MILLION DOLLARS IN CONSTRUCTING THE CALIFORNIA AQUEDUCT SYSTEM. IT IS THE FIRST STATEWIDE WATER RESOURCES DEVELOPMENT IN THE UNITED STATES. IT IS THE LARGEST SINGLE HYDRO PROJECT IN THE WORLD TO BE FINANCED AT ONE TIME. THE 450 MI CALIFORNIA AQUEDUCT MAKES USE OF 21 PUMPING STATIONS. LARGEST OF THE STATIONS (EDMONSTON) IS ALSO AMONG THE LARGEST IN THE WORLD. IT WILL REQUIRE UP TO 6.2 BILLION KWH/HR TO OPERATE ITS HUGE PUMPS. (EI-46116).

01173. DISSOLVED AIR ION FLOTATION OF INDUSTRIAL WASTES HEXAVALENT CHROMIUM.

GRIEVES, R.B.; ETTELT, G.A.; SCHRODT, J.T.; BHATTACHARYYA, D.
PURDUE UNIV., ENG. EXTENSION SERIES 132, PT. 1, P 154-164, 1969.

STUDY TO EVALUATE EFFICIENCY OF PILOT PLANT SCALE, DISSOLVED AIR ION FLOTATION UNIT FOR REMOVAL AND CONCENTRATION OF DICHROMATE. EVALUATION IS BASED ON FRACTIONAL FLOTATION (REMOVAL) OF DICHROMATE, ENRICHMENT RATIO FOR DICHROMATE, AND FRACTIONAL FLOTATION (REMOVAL) OF SURFACTANT. EACH DEPENDENT VARIABLE IS RELATED ANALYTICALLY TO FIVE INDEPENDENT VARIABLES BY MULTIPLE REGRESSION ANALYSIS. OPTIMUM VALUES OF INDEPENDENT VARIABLES ARE DETERMINED AND CHEMICAL COST ESTIMATE IS CARRIED OUT, BASED ON EXPERIMENTALLY VERIFIED PROCESS FOR SURFACTANT RECOVERY AND REUSE. 10 REFS. (EI-13443).

01174. IMPROVEMENT OF WATER QUALITY UNDER FINANCIAL CONSTRAINT.

REVELLE, C.; DIETRICH, G.; STENSEL, D.
WATER RESOURCES RESEARCH, 5(2), 507-513, 1969.

LIMITED FUNDS FOR BUILDING TREATMENT FACILITIES ON RIVER BASIN ARE ALLOCATED TO SECURE LARGEST POSSIBLE VALUE OF MINIMUM LEVEL OF DISSOLVED OXYGEN; LINEAR PROGRAMMING IS UTILIZED TO DETERMINE CONFIGURATION OF EFFICIENCIES THAT ACHIEVE THIS GOAL; AT OPTIMALITY, DUAL VARIABLE ASSOCIATED WITH FINANCIAL CONSTRAINT INDICATES INSTANTANEOUS RATE OF CHANGE OF MINIMUM DISSOLVED OXYGEN

CONCENTRATION WITH RESPECT TO FUNDS AVAILABLE; SEVERAL ALTERNATIVE FORMULATIONS OF PROBLEM ARE DISCUSSED. (EI-12523).

01175. JACKS LIFT WATER TANK 120 FT TO SAVE CONSTRUCTION COST.

AUSTRALI[illegible]IV ENG., 10(6), 38-39, 1969.

100,000 GAL CONCRETE WATER TANK AT MELBOURNE'S TULLAMARINE AIRPORT WAS JACKED TO THE TOP OF A 120 FT HIGH TOWER AFTER BEING CONSTRUCTED AT GROUND LEVEL. JACKING EQUIPMENT SUPPORTED BY A PRESTRESSED CONCRETE CAP AT THE TOP OF THE 120 FT HIGH SHAFT RAISED THE TANK TO ITS FINAL POSITION. (EI-11712).

01176. DEEP WELL DISPOSAL. ARE SAFEGUARDS BEING IGNORED.

SHELDRICK, M.G.
CHEM ENG, 76(7), 74-46, 18, 1969.

MOST STATES MUST GRANT PERMIT FOR DEEP WELL IF APPLICANT CAN PROVE ENGINEERING AND GEOLOGIC FEASIBILITY OF IT; MOST STATES HAVE NOT ORGANIZED THEMSELVES TO EVALUATE DEEP WELL DISPOSAL AS METHOD OF POLLUTION CONTROL; STATES GENERALLY HAVE ADAPTED EXISTING LAWS TO COVER DEEP WELL DISPOSAL APPLICATIONS, WITH PARTICIPATION IN DECISION BY SEVERAL AGENCIES--HEALTH DEPARTMENT FOR PROTECTION OF DRINKING WATER, OIL AND GAS DEPARTMENT, FOR PROTECTION OF NATURAL RESOURCES, AND CONSERVATION DEPARTMENT FOR LAND USAGE. (EI-09847).

01177. CONSTRUCTION COSTS OF RURAL WATER SYSTEMS.

STOLTENBERG, D.H.
PUB WORKS, 100(8), 94-96, 130, 1969.

CONSTRUCTION COSTS AS REFLECTED BY BID TABULATIONS RECEIVED ON MANY OF THE NEW WATER SUPPLY SYSTEMS IN RURAL COMMUNITIES UNDER 5500 POPULATION IN RURAL DISTRICTS IN ILLINOIS. COSTS OF TREATMENT, DISTRIBUTION AND STORAGE ARE COVERED, AS WELL AS GROUNDWATER TREATMENT FACILITY COSTS, AVERAGE COSTS OF INSTALLATION OF WATER MAINS AND STORAGE TANKS. (EI-16503).

01178. TELEMETRY INSTALLATION FOR CENTRAL CONTROL OF SUNDERLAND AND SOUTH SHIELDS WATER SYSTEM.

PEPPER, R.A.; BANKS, W.
INSTN WATER ENGRS, J., 23(5), 299-349, 1969.

EVENTS IN ACTIVITIES OF SUNDERLAND AND SOUTH SHIELDS WATER CO IN GREAT BRITAIN WHICH LED TO CENTRAL CONTROL ORGANIZATION, USING LATEST TELEMETRY TECHNIQUES ARE OUTLINED; PROBLEMS EXPERIENCED DURING COURSE OF CONTRACT ARE DISCUSSED. TOTAL COSTS INCURRED, PRINCIPAL CONTRACTORS, AND FACILITIES PROVIDED ARE GIVEN, AS WELL AS TECHNICAL DESCRIPTION OF TELEMETRY EQUIPMENT. (EI-25896).

01179. DESIGN AND COST OF ION EXCHANGE SOFTENING FOR 50-MGD SEAWATER EVAPORATION PLANT.

KLEIN, G.; MAKAR, K.M.; TLEIMAT, B.W.; VERMEULEN, T.
CALIFORNIA UNIV. SEA WATER CONVERSION LABORATORY, SALINE WATER CONVERSION RESEARCH-REPORT 68, SEPT 2, 1968, 59 P. 6(3), 20-23, 1969.

REPORT DEALS WITH THE PRETREATMENT OF SEAWATER TO AVOID SCALE FORMATION DURING DISTILLATION. ION EXCHANGE IS USED FOR THE REMOVAL OF CALCIUM FROM SEAWATER, FOLLOWED BY ACIDIFICATION AND DEAERATION TO ELIMINATE CARBONATE IONS. COST OF PRETREATMENT HAS BEEN ESTIMATED FOR AN ASSUMED PLANT CAPABLE OF PRODUCING 50 MGD OF DISTILLED WATER. DESIGNS OF THE ION EXCHANGE INSTALLATION AND OF ITS OPERATINGCYCLE ARE BASED ON A BODY OF PERTINENT EXPERIMENTAL DATA OBTAINED PREVIOUSLY IN THIS LABORATORY. (EI-14226).

01180. IMPROVEMENTS TO THE QUALITY OF WASTEWATER FROM HUMBLE'S BATON ROUGE REFINERY.

DENBO, R.T.
CHEM ENG PROGR SYMP SER, 65(97), 259-264, 1969.

SUBSTANTIAL INVESTMENT FOR WASTEWATER HAS BEEN EXPENDED BY REFINERY DURING THE PAST 10 YR. NEW INVESTMENT OF 30 MILLION DOLLARS FOR 400,000 PLUS B/D REFINERY IS PLANNED ULTIMATELY TO REPLACE ONCE THROUGH RIVER WATER SYSTEM, WHICH CURRENTLY PROVIDES ABOUT 30% OF PRODUCT COOLING CAPACITY, AND FOR SECONDARY TREATMENT FACILITIES. THIS WATER CLEANLINESS PROGRAM IS IMPORTANT TO PROTECT DOWNSTREAM COMMUNITIES USING RIVER WATER FOR DOMESTIC PURPOSES. PRIMARY CONTAMINANTS DEALT WITH ARE OIL AND PHENOLIC COMPOUNDS IN RIVER WATER REPLACEMENT PROGRAM. (EI-44661).

01181. ECONOMICS OF WASTE TREATMENT.

NEMEROW, N.L.
PROCEEDINGS OF FIRST MID-ATLANTIC INDUSTRIAL WASTE CONFERENCE, NOV 13-15 1967; UNIVERSITY OF DELAWARE, DEPT CIV ENG, NEWARK, DEL, MAY 1968. EI-41486.

01182. EFFECT OF SUSPENDED SOLIDS, ORGANIC MATTER AND TOXIC MATERIALS ON AQUATIC LIFE IN RIVERS.

PATRICK, R.
PROCEEDINGS OF FIRST MID ATLANTIC INDUSTRIAL WASTE CONFERENCE, NOV 3-15 1967; UNIVERSITY OF DELAWARE, DEPT CIV ENG, NEWARK, DEL, MAY 1968. (EI-41486.

01183. OVERVIEW OF INDUSTRIAL WATER COSTS.

BRAMER, H.C.; MOTZ, D.J.
INDUS WATER ENG., 6(3), 20-23, 1969.

THE GOAL OF STUDY CONDUCTED WAS TO DEVELOP METHODOLOGY BY WHICH INDIVIDUAL FIRMS CAN DETERMINE INDUSTRIAL WATER UTILIZATION COSTS IN A CONSISTENT AND RELIABLE MANNER FOR SYSTEMS OF ANY SIZE AND COMPOSITION. DATA FOR THE STUDY WAS

OBTAINED FROM 22 PLANTS IN THE STEEL, PETROLEUM, PAPER AND ELECTRIC POWER INDUSTRIES, INDUSTRIES WHICH ACCOUNT FOR THREE FOURTHS OF ALL INDUSTRIAL WATER USES. TOTAL WATER UTILIZATION COSTS HAVE BEEN EXPRESSED IN 10 PARAMETERS. (EI-14876).

01184. WATER TREATMENT COSTS FOR SMALL PLANT.

BURTON, F.L.; THEISEN, H.M.; SNOEYINK, V.L.
INDUS WATER ENG., 6(3), 24-26, 1969.

OVER 400 INTERVIEWS WERE CONDUCTED WITH INDUSTRIAL AND COMMERCIAL ESTABLISHMENTS IN NINE URBAN AREAS, SELECTED BECAUSE OF THE WIDE RANGE OF WATER QUALITY WHICH THEY AFFORDED. THE DATA COLLECTED WAS CONVERTED TO ANNUAL COSTS WHICH INCLUDED CAPITAL INVESTMENT, LABOR INVOLVED IN THE TREATMENT, LABOR AND MATERIAL COSTS FOR EQUIPMENT MAINTENANCE, COST OF CHEMICALS AND SUPPLIES. THE DATA WAS ANALYZED FOR CORRELATIONS BETWEEN THE ANNUAL COST OF THE TREATMENT AND FACTORS SUCH AS THE QUANTITY OF WATER TREATED AND VARIOUS QUALITY PARAMETERS. (EI-14235).

01185. PHOSPHORUS REMOVAL, THE PRESENT AND POSSIBLE PROGRESS.

HALL, M.W.; ENGELBRECHT, R.S.
SANITARY & WATER RESOURCES ENG CONFERENCE, 7TH-PROC MAY 30-31 1968 P 75-89.

PURPOSE OF PAPER IS TO REVIEW METHODS THAT ARE CURRENTLY USED FOR REMOVING PHOSPHORUS FROM WASTEWATERS AND TO EXAMINE CERTAIN OTHER PROCESSES WHICH APPEAR TO OFFER PROMISE OF PROVIDING FUTURE IMPROVEMENTS. COMPARISON IS PRESENTED ON BASIS OF COST, EFFICIENCY AND TYPE OF WASTE GENERATED BY THE PROCESS OF THE PHOSPHORUS REMOVAL BY USING METHODS OUTLINED IN DISCUSSION. (EI-21322).

01186. WHAT IS QUALITY WATER.

BEAN, E.L.
UNIV. ILLINOIS, COLLEGE OF ENG, SANITARY ENG CONFERENCE, 11TH PROC, FEB 5-6, 1969, P 9-16.

COST OF MEETING PRESENT DAY STANDARDS SET BY THE 'QUALITY GOALS FOR POTABLE WATER' COMMITTEE OF AWWA CAN BE REDUCED BY POLLUTION CONTROL OF THE WATER RESOURCE. THE ULTIMATE GOAL OF CONSISTENTLY HIGH QUALITY POTABLE WATER REQUIRES FURTHER RESEARCH IN REGARD TO CHEMICAL AND ORGANIC POLLUTANTS, CORROSION, AND DISEASE CARRYING BACTERIA. (EI-18156).

01187. REVIEW OF RADIOACTIVE WASTE MANAGEMENT IN WESTERN EUROPE.

DEJONGHE, P.
ATOMIC ENERGY REV, 5(5), 169-180, 1967.

METHODS HAVE BEEN DEVELOPED OR ADAPTED CAPABLE OF ENSURING RELIABLE OPERATION AND SATISFACTORY DECONTAMINATION. THESE METHODS ARE AVAILABLE FOR MOST KNOWN TYPES OF RADIOACTIVE WASTES, WHERE NEW METHODS ARE UNDER DEVELOPMENT (E. G., FOAM SEPARATION, SOLAR EVAPORATION, APPLICATION OF POLYELECTROLYTES), PURPOSE IS ESSENTIALLY IMPROVEMENT OF ECONOMICS OF WASTE MANAGEMENT SYSTEM; ECONOMIC ASPECT BECOMES LEADING FACTOR IN WASTE MANAGEMENT AND IN DEVELOPMENT OF NEW OR OPTIMIZED METHODS OF TREATMENT, FOR SOME TYPICAL WASTES, NEW AND CHARACTERISTIC METHODS ARE UNDER DEVELOPMENT. (EI).

01188. BIOLOGICAL TREATMENT OF TEXTILE EFFLUENTS.

BIGGS, A.I.
CHEM & INDUSTRY, 37, 1967 P 1536-1538.

ARTICLE CONCENTRATES ON INVESTIGATION AND RESEARCH WHICH HAVE BEEN CARRIED OUT IN FIELD OF BIOLOGICAL TREATMENT AND DOES NOT ATTEMPT TO DEAL WITH PROBLEMS OF HARNESSING THESE RESULTS TO PRACTICAL USE AT INDIVIDUAL PLANTS; MOST EFFLUENTS ARISE FROM WOOL INDUSTRY (SCOURING AND FINISHING), COTTON INDUSTRY (PROCESSING, BLEACHING AND FINISHING), JUTE INDUSTRY (BLEACHING AND FINISHING) AND MAN-MADE FIBERS INDUSTRY (PROCESSING AND FINISHING); FACTORIES CONCERNED HAVE TO UNDERTAKE VERY CONSIDERABLE CAPITAL COST OF INSTALLING THEIR OWN BIOLOGICAL TREATMENT PLANT OR BECOME MAJOR CONTRIBUTOR TO CAPITAL COST OF BUILDING NEW SEWAGE PLANT. (EI).

01189. WASTE WATER TREATMENT BY CONTACT STABILIZATION AT PENETANGUISHENE, ONT.

JONES, P.H.
WATER & POLLUTION CONTROL, 106(2), 34-35, 38-39, 1968.

STUDY OF CONCEPT, DESIGN, CONSTRUCTION, OPERATION AND PERFORMANCE OF MODIFIED ACTIVATED SLUDGE PROCESS; BIODEGRADABILITY STUDY WAS UNDERTAKEN TO DETERMINE PARAMETERS OF DESIGN OF TREATMENT PROCESS AND PLANT; RESULTS OF NUMBER OF TESTS SHOWED THAT CONTRACT STABILIZATION PROCESS IS ECONOMICAL IN CAPITAL AND OPERATING COSTS AND ALSO IN SPACE REQUIRED; IT IS NOT SUITABLE FOR EVERY TYPE OF WASTE AND IS AFFECTED CONSIDERABLY BY SOLUBILITY INDEX: BOD SOLUBLE/BOD TOTAL. (EI).

01190. SEWAGE EFFLUENT CHLORINATION PRACTICES IN ILLINOIS AND INDIANA.

JULIANO, F.E.
WATER & SEWAGE WORKS, 115(1), 27-32, 1968.

DETAILED TABLES AND ACCOMPANYING EXPLANATIONS PROVIDE ACCURATE REPORT ON CHLORINATION PRACTICES AND COSTS IN ILLONOIS AND INDIANA; TO COMPARE TOTAL ANNUAL COSTS OF LIQUID CHLORINE VS SODIUM HYPOCHLORITE, INVESTIGATION INCLUDED STUDY OF VARIOUS COST ASSOCIATED ACTIVITIES OF CHLORINATION. (EI).

01191. WATER TREATMENT PAYS OFF.

WATERS, C.E.
MODERN PLASTICS, 45(7), 1968, P 114, 116, 118.

ENGINEERING OF MOD COOLING SYSTEM SHOULD INCLUDE EVALUATION OF WATER TREATMENT AS MEANS OF REDUCING REFRIGERATION CAPACITY REQUIREMENTS, POWER COSTS, MAINTENANCE, AND OTHER COSTLY FACTORS; BECAUSE OF INTERRELATIONSHIP OF WATER AND CHILLING TREATMENT, AND VARIABLES FOR EACH PLANT, IT IS ADVANTAGEOUS TO HAVE CHILLING REQUIREMENTS AND WATER TREATMENT PROBLEMS ANALYZED SIMULTANEOUSLY WITH RESPECT TO EACH OTHER. (EI).

COST ANALYSIS OF WATER POLLUTION CONTROL

01192. ARE DRY COOLING TOWERS ECONOMICAL.

RABB, A.
HYDROCARBON, 47(2), 122-124, 1968.

DESCRIPTION OF DRY COOLING TOWER SYSTEM ALREADY SUCCESSFULLY USED IN POWER INDUSTRY: COMPARISON OF ITS ECONOMY (INVESTMENT AND OPERATING COSTS) WITH THAT OF CONVENTIONAL 'WET' SYSTEM FOR STEAM TURBINE DRIVES WITH CAPACITY APPLICABLE TO PETROLEUM AND CHEMICAL INDUSTRY; SELECTED EXAMPLE INDICATES THAT DRY COOLING TOWWER SYSTEM CAN COMPETE ECONOMICALLY WITH WET SYSTEM IF CHEAP COOLING WATER IS NOT AVAILABLE. (EI).

01193. WATER POLLUTION CONTROL- GEARING PERFORMANCE TO PROMISE.

CLEARY, E.J.
CIV ENG., NY, 38(1), 62-64, 1968.

PERFORMANCE IN CURBING WATER POLLUTION IS NOT MATCHING PUBLICIZED PROMISES: STATES AND COMMUNITIES, RATHER THAN BEING SPURRED TO ACTION BY FEDERAL MONEY, WAIT FOR EVEN GREATER SUBSIDIES, WHICH NOW MAY BE AS MUCH AS 70%; INTERSTATE COMPACT AGENCIES OFFER MEANS OF CONTROLLING WATERSHED; NEW AUTHORITIES WITHIN STATES MAY BE MEANS TO ASSESS AND COLLECT COSTS EQUITABLY; MIAMI (OHIO) CONSERVANCY DISTRICT IS UNDERTAKING RIVER CLEAN UP IN SAME WAY IT SUCCESSFULLY SOLVED ITS OWN FLOOD CONTROL PROBLEM MORE THAN 50 YR AGO. MONEY WILL COME FROM MUNICIPALITIES, COUNTIES AND INDUSTRIES IN RIVER BASIN. (EI).

01194. STUDYING BIODEGRATION POSSIBILITIES OF INDUSTRIAL EFFLUENTS: APPLICATION TO BIODEGRATION OF PHENOLS. (IN FRENCH).

BREBION, G.; CABRIDENC, R.; HURIET, B.
INST FRANCAIS DU PETROLE ET ANNALES DES COMBUSTIBLES LIQUIDES--REV, 22(6), 1029-1052, 1967.

THEORETICAL ASPECTS OF BIOLOGICAL PURIFICATION, DEVELOPMENT CONDITIONS AND BIOLOGY OF MAIN MICRO ORGANISMS ARE DESCRIBED; LABORATORY STUDIES TO OBTAIN METHOD THAT CAN BE USED ALONE OR IN COMBINATION FOR PURIFICATION OF INDUSTRIAL WASTE WATER; RESULTS WERE APPLIED TO OPERATION OF PILOT PLANT AND SEMI-INDUSTRIAL PLANT WITH LEAST COSTS; RESULTS OF METABOLIZATION OF PHENOLS (PHENOL, CRESOL, AND POLYSUBSTITUTED PHENOLS). IN FRENCH WITH ENGLISH AND SPANISH ABSTRACTS. (EI-00492).

01195. PHOSPHORUS REMOVAL. STATE OF ART.

NESBITT, J.B.
J WATER POLLUTION CONTROL FED., 41(5), 701-713, 1969.

LITERATURE REVIEW ON ANALYTICAL PROCEDURES AND PHOSPHORUS REMOVAL METHODS BRINGS TO CONCLUSION THAT CURRENT METHODS OF MEASURING PHOSPHORUS ARE INADEQUATE; REMOVAL PRACTICES STUDIED ARE BIOLOGICAL METHODS, CHEMICAL TREATMENT, AND CHEMICAL BIOLOGICAL TREATMENT; ANALYSIS OF ALL METHODS SHOWS THEM TO BE FEASIBLE, BUT AT PROBABLE DOUBLING OF NORMAL TREATMENT PLANT COSTS. (EI-38307).

01196. OPERATIONAL COSTS OF TRICKLING FILTERS IN SOUTHEAST.

FRANZMATHES, J.R.
J WATER POLLUTION CONTROL FED., 41(5), 814-821, 1969.

OPERATIONAL COST DATA ARE TAKEN FROM PLANT OPERATING REPORTS OF TRICKLING FILTER, POST CHLORINATION WASTEWATER TREATMENT FACILITIES IN SOUTHEAST UNITED STATES; GENERALIZED CONCEPT OF OPERATING COSTS AND RATE OF INCREASE IS DEVELOPED BY RELATING DESIGN AND ACTUAL FLOW TO TOTAL COST; 42 PLANTS WERE INCLUDED IN STUDY; USING ACTUAL FLOW AS PARAMETER, COSTS INCREASED 55% WHEN FLOW DOUBLED; USING DESIGN FLOW, INCREASE WAS 64%. (EI-37017).

01197. SECONDARY PLANT EFFLUENT POLISHING.

CULP, G.
WATER & SEWAGE WORKS, 115(4), 145-147, 1968.

MIXED MEDIA FILTRATION OF ACTIVATED SLUDGE EFFLUENT WITHOUT CHEMICAL COAGULATION PROVIDES EFFECTIVE REMOVAL OF SUSPENDED SOLIDS AND RELATED BOD; AT TOTAL COST (CAPITAL AND OPERATING) OF ABOUT 1 CENT/1000 GAL, SUSPENDED SOLIDS AND BOD OF LESS THAN 5 MG/LITER AND TURBIDITY OF LESS THAN 5 JTU CAN BE ACHIEVED; MIXED MEDIA CONCEPT HAS BEEN INTEGRATED WITH LOW RESIDENCE TIME SETTLING DEVICE TO PROVIDE EFFLUENT FILTRATION SYSTEM; CHEMICAL COAGULATION FOLLOWED BY SEDIMENTATION AND FILTRATION OF SECONDARY EFFLUENT IS MOST ECONOMICAL PROVEN MEANS OF PROVIDING VERY LOW PHOSPHATE CONCENTRATIONS; FINAL EFFLUENT PHOSPHATE CONCENTRATION AND COST OF PHOSPHATE REMOVAL ARE PROPORTIONAL TO AMOUNT OF COAGULANT ADDED. (EI-04007).

01198. PLANNING COMPREHENSIVE SOLID WASTES MANAGEMENT SYSTEMS.

HICKMAN, H.L.JR.
ASCE J SANITARY ENGINEERING, 94(SA6), PAPER 6063, 1147-1152, 1968.

AUTHOR STRESSES THAT ALL AVAILABLE MANAGEMENT TOOLS MUST BE USED BY ENGINEER IN PLANNING FOR SYSTEM; PLANNING MUST BE APPROACHED BY EFFECTIVE PROBLEM SOLVING TEAMS; THESE TEAMS MUST CONSIDER DEFINITION OF GOALS, AND PLANNED DEVELOPMENT OF STUDY AREA: EVALUATE EXISTING SYSTEMS IN STUDY AREA; DETERMINE CONFIGURATION OF FUTURE SYSTEM; HOW TO IMPLEMENT RESULTANT PLAN, AND COSTS AND FINANCING OF SYSTEM. (EI-17091).

01199. NEW APPROACHES TO WASTEWATER TREATMENT.

STENBURG, R.L.; CONVERY, J.J.; SWANSON, C.L.
ASCE J SANITARY ENGINEERING, 94(SA6), PAPER 6296, 1121-1136, 1968.

RESEARCH AND DEVELOPMENT WORK CARRIED OUT ON WASTE TREATMENT TECHNOLOGY BY CINCINNATI WATER RESEARCH LABORATORY; PILOT PLANT ACTIVITIES AS WELL AS LARGE SCALE TREATMENT PLANTS ARE INCLUDED; PROJECT COVERS TECHNICAL AND ECONOMIC EVALUATION OF PROCESS OR COMPLETE TREATMENT SYSTEM OR DEVELOPMENT OF METHODS FOR REDUCINNG WATER POLLUTION OF GIVEN TYPE OR AT SPECIFIC LOCATION; TREATMENT TECHNIQUES ARE TWO STAGE LIME PRECIPITATION WITH LIME RECOVERY AND REUSE,

REFERENCE LIST

GRANULAR ACTIVATED CARBON ABSORPTION, AND VARIETY OF BIOLOGICAL AND CHEMICAL TECHNIQUES FOR REMOVING ALGAL NUTRIENTS, NITROGEN AND PHOSPHORUS. (EI-17199).

01200. CONTACT STABILIZATION.

JONES, P.H.
14TH ONTARIO INDUS WASTE CONFERENCE PROC JUNE 18-21 1967, NIAGARA FALLS, ONT, P 225-243.

CONTACT STABILIZATION PROCESS DESIGNED TO PROVIDE FOR BRIEF CONTACT OR MIXING PERIOD BETWEEN INCOMING RAW SEWAGE AND ACTIVATED SLUDGE IS DESCRIBED; SERIES OF BATCH STUDIES WERE UNDERTAKEN TO DETERMINE EFFECT OF SOLUBILITY, OPTIMUM SOLIDS CONCENTRATION, AND FULL SCALE OPERATION OF CONTACT STABILIZATION PLANT; PROCESS IS SHOWN TO OFFER ECONOMY OF FIRST COST, ECONOMY AND FLEXIBILITY OF OPERATION AND MINIMUM OF SKILLED ATTENTION. (EI-23532).

01201. LAGOONS FOR MILITARY SEWAGE TREATMENT IN SOUTH VIETNAM.

DUTTWEILER, D.W.; BURGH, J.A.
CIV ENG (NY), 39(5), 47-49, 1969.

LAGOON TREATMENT OF MILITARY WASTE WATERS IN SOUTHEAST ASIA WAS FOUND TO BE EFFECTIVE, ECONOMICAL, AND INNOCUOUS; SUCCESSFUL POND PERFORMANCE SUGGESTS THAT DESIGN CONCEPT WILL CONTINUE TO BE EMPLOYED TO PROVIDE MILITARY FACILITIES FREE OF COMPREHENSIVE MECHANICAL EQUIPMENT; U S MILITARY ASSISTANCE COMMAND, VIETNAM, DESIGN CRITERIA ARE UNDER REVISION, IN LIGHT OF MILITARY ENGINEER INVESTIGATIONS AND OPERATIONAL EXPERIENCE; SIMPLICITY OF CONSTRUCTION AND OPERATION OF WASTE STABILIZATION AND LAGOONS IS SHOWN TO BE MAJOR ADVANTAGE FOR MILITARY APPLICATIONS AND FOR CIVILIAN USE IN THIS AREA OF WORLD. (EI-30665).

01202. RENOVATED WASTEWATERS.

PORTER, J.W.; HOPKINS, A.N.; FISHER, W.L.
AM CITY, 84(5), 140-142, 1969.

TREATMENT PROCESSES WERE SELECTED FOR FIVE PLANTS TO PRODUCE PRODUCT WATER OF INCREASINGLY BETTER QUALITY TO ESTIMATE COSTS OF INCREMENTAL QUALITY IMPROVEMENTS; PROCESSES COMPRISED IN EACH PLANT ARE SUMMARIZED AND ILLUSTRATIVE USES FOR PRODUCT WATER ARE INCLUDED; ALSO GIVEN ARE INFLUENT AND PRODUCT WATER ANALYSIS AND COST DATA FOR 30 MGD PLANTS. (EI 29399).

01203. RECLAMATION OF POTABLE WATER FROM WASTEWATER.

STANDER, G.J.
J WATER POLLUTION CONTROL FED., 41(3), 355-367, 1969.

BIOLOGICAL CHEMICAL PILOT PLANT WAS INITIATED AT WINDHOEK, SOUTH WEST AFRICA, FOR FUTURE 1-MGD RECLAMATION PLANT TO HELP SOLVE WATER SHORTAGE PROBLEM; PROCESSES INCORPORATED INCLUDE FLOTATION, AMMONIA STRIPPING, RECARBONIZATION-STABILIZATION, SAND FILTRATION, FOAM FRACTIONATION, CHLORINATION, AND ACTIVATED CARBON FILTRATION; COSTS OF EACH PROCESS ARE INCLUDED; STUDIES INDICATE THAT THIS SYSTEM CAN PRODUCE POTABLE WATER FOR 0.215 AND 0.27 CENTS/1000 GAL FOR FINAL SETTLING TANK AND PRIMARY CLARIFIED WASTEWATER, RESPECTIVELY. (EI-39325).

01204. COOLING TOWERS.

THOMPSON, A.R.
CHEM ENG., 75(22), 100-102, 1968.

MORE USUAL APPLICATION CONCEPT OF COOLING TOWERS FOR EXISTING PLANTS AND MANY NEW PLANTS IS OPEN SYSTEM OR 'HELPER' OR 'PEAKING' TOWER CONCEPT; HELPER TOWER NEEDS TO BE OPERATED ONLY FEW MONTHS EACH YEAR WHEN MAXIMUM STREAM TEMPERATURES WOULD BE EXCEEDED BY PLANT HEAT LOAD; TOWER COSTS CAN BE ESTIMATED FROM WATER-FLOW AND COOLING-RANGE GRAPHS; IN APPLYING COOLING TOWERS TO SATISFY THERMAL RESTRICTIONS ON NATURAL WATERS, BOTH CLOSED AND OPEN SYSTEM SHOULD BE ANALYZED TO SEE WHICH WILL BE MORE ECONOMICAL BASED ON INSTALLED COST AND OPERATING COST FOR EACH SPECIFIC INSTALLATION; PROPER SYSTEM WITH CORRECT TOWER APPLICATION AND TEMPERATURE SELECTION CAN RESULT IN OPTIMIZING COSTS. (EI-21841).

01205. AUTOMATIC COOLING TOWER CONTROL.

FEITLER, H.; TOWNSEND, C.R.
CHEM ENG PROGRESS, 65(5), 63-67, 1969.

THIS PAPER REPORTS MAJOR FUNCTIONAL AND OPERATIONAL CONCEPTS USED IN DESIGN OF WATER COOLING TOWER CONTROL SYSTEMS; BOTH NORMAL AND EMERGENCY OPERATION AND ITS RELATIONSHIP TO SCALE AND CORROSION CONTROL ARE EMPHASIZED; GENERALIZED ECONOMIC DATA INDICATE THAT INSTALLATION OF CONTROL SYSTEM DESCRIBED COULD PAY FOR ITSELF IN 1 YR. (EI-39234).

01206. ADVANCES IN WATER QUALITY IMPROVEMENT.

GLOYNA, E.F.; ECKENFELDER, W.W.JR.
UNIV OF TEXAS PRESS, AUSTIN, 1968, 513 P.

SYMPOSIUM PRODUCED THIRTY FOUR PAPERS GROUPED IN THREE SECTIONS; SECTION ONE (EFFECTS OF POLLUTANTS ON STREAMS) IS DEVOTED WATER RESOURCE CONSERVATION, SPECIFICALLY TRANSPORT OF WASTES IN STREAMS AND ECOLOGY OF AQUATIC ENVIRONMENT; SECTION TWO IS SPECIFICALLY DIRECTED TO LATEST CONCEPTS IN ADVANCED BIOLOGICAL WASTE TREATMENT; AND SECTION THREE PERTAINS TO CURRENT TRENDS IN LOW COST TREATMENT PRACTICES; PRACTICES IN USE OF WASTE STABILIZATION PONDS FOR BIOLOGICAL TREATMENT OF WASTE CONTAINING ORGANIC POLLUTANTS ARE CONSIDERED; ADVANCES IN DESIGN CRITERIA ARE DESCRIBED. (EI-25479).

01207. INTERLAKE'S WATER POLLUTION PROGRAM.

BAYR, R.B.
BLAST FURNACE & STEEL PLANT, 57(5), 370-373, 1969.

POLLUTION POLICIES AND PHILOSOPHY ARE ITEMIZED; AT RIVERDALE PLANT, STEPS HAVE BEEN AND WILL BE TAKEN TO PROVIDE TOTAL RECIRCULATION IN CLOSED SYSTEM; COKE PLANT WILL INSTALL CLOSED RECIRCULATING SYSTEM AT QUENCHING OPERATION AND NAPTHALENE REMOVAL AT FINAL COOLERS; BLAST FURANCES AND SINTER PLANT WILL INSTALL CLOSED SYSTEM WHICH WILL REMOVE BOTH SUSPENDED AND DISSOLVED SOLIDS; FEDERAL WATER POLLUTION AGENCY

HAS APPROVED GRANT TO COVER ONE-THIRD OF COST. (EI-26278).

01208. COST OF INDUSTRIAL AND MUNICIPAL WASTE TREATMENT IN MAUMEE RIVER BASIN.

MATSON, J.V.; BENNETT, G.F.
ASME-PAPER 69-PID-4 FOR MEETING JUNE 10-12 1969, 8 P.

COSTS OF WASTEWATER TREATMENT IN RIVER BASIN WERE BALANCED AGAINST BENEFITS ACCRUING FROM IMPROVEMENTS IN WATER QUALITY FOR VARIOUS DEGREES OF TREATMENT OF INDUSTRIAL AND MUNICIPAL EFFLUENTS TO DETERMINE OPTIMUM BENEFIT COST POINT; COMPREHENSIVE PROGRAM, INCLUDING SECONDARY TREATMENT OF ALL EFFLUENTS, TERTIARY TREATMENT FOR NUMBER OF CITIES ON CRITICAL STREAM STRETCHES, AND PHOSPHATE REMOVAL PROGRAM, PROVIDED ECONOMIC OPTIMUM; AT THAT POINT, BENEFIT COST RATIO APPROACHED UNITY. (EI-24637).

01209. GUIDE TO COSTING OF WATER FROM NUCLEAR DESALINATION PLANTS.

INT ATOMIC ENERGY AGENCY-TECH REPORTS ER 80, 196, 84 P.

METHOD ENABLES PRELIMINARY ESTIMATES OF WATER COST UTILIZING NUCLEAR ENERGY FOR ALMOST ANY SET OF CONDITIONS; APPLIED RESEARCH AND ENGINEERING LIMITED WAS COMMISSIONED TO PREPARE SUCH METHOD AND RESULTS ARE PRESENTED; SECTIONALIZED DATA FROM WHICH POTENTIAL USER COULD BUILD UP COST OF POWER AND WATER FOR PARTICULAR CASE ARE IN FORM OF SERIES OF INDIVIDUAL COST AND PERFORMANCE CURVES; HIGH PRESSURE STEAM LEAVING NUCLEAR OR STEAM RAISING ISLAND HAS BEEN TREATED AS ONE SECTION WITH COSTS BEING PRESENTED FOR LIGHT WATER, GAS COOLED AND FAST BREEDER REACTOR SYSTEMS, TOGETHER WITH COST OF STEAM FROM FOSSIL FUELED BOILERS FOR COMPARISON PURPOSES. EXAMPLES PRESENTED DEMONSTRATE METHOD. (EI-51625).

01210. HOW TO TREAT COOLING WATER.

DURKIN, J.
CAN CHEM PROCESSING 52(9), 83-84, 86, 88, 1968.

IF RAW MAKE-UP WATER CONTAINS ABOVE NORMAL QUANTITIES OF SUSPENDED PARTICLES, COAGULATION AND FILTRATION MAY BE REQUIRED TO OVERCOME PROBLEM OF SCALE DEPOSITION; EFFECTIVE CORROSION CONTROL PROGRAM MUST GIVE GENERAL CORROSION RATES OF 1 TO 2 MILS/YR OR LESS; CHLORINE IS USED AS BASIC TOXICANT IN MAJORITY OF COOLING WATER SYSTEMS, AS IT IS EFFECTIVE, FAST-ACTING AND ECONOMICAL; CONTROL OF MICROBIOLOGICAL ATTACK IN FLOODED SECTIONS OF TOWER IS POSSIBLE BY ADDITION OF VARIOUS FUNGICIDES AND SLIMICIDES TO CIRCULATING WATER; THIS CAN BE ACHIEVED THROUGH USE OF NONOXIDIZING BIOCIDE SUGGESTED AS SUPPLEMENT TO CHLORINATION TREATMENT. (EI-23147).

01211. NEW CATION BED CUTS NEUTRALIZING COSTS.

APPLEBAUM, S.B.
POWER, 112(8), 82-83, 1968.

DUAL LAYER CATION BED, INSTALLED AS PART OF DEMINERALIZER PLANT EXPANSION, SAVES ABOUT 11,000 DOLLARS PER YEAR IN CAUSTIC AND ACID FOR TEXAS CHEMICAL PLANT; SAVINGS COME FROM BOTH LOWER AMOUNT OF ACID NEEDED TO REGENERATE NEW CATION UNIT AND ELIMINATION OF CAUSTIC SODA NECESSARY TO NEUTRALIZE EXCESS OF ACID REGENERANT FOR OLD PLANT PRIOR TO DISCHARGE. (EI-48477).

01212. OPERATION AND COST OF ION EXCHANGE CIRCULATION PLANT FOR TREATMENT OF RINSING WATER FROM PICKLING DEPARTMENT IN ROLLING MILLS.

PLUEMER, L.
WIRE WORLD INT., 10(4), 110-113, 1968.

ADVANTAGES OF CIRCULATION OF RINSING WATER IN ROLLING MILLS ARE CITED; ION EXCHANGE PROCESSES ARE EXTENSIVELY USED IN ELECTROPLATING INDUSTRY AND BEING INTRODUCED INTO IRON AND STEEL PLANTS; OPERATION OF THIS TYPE OF SYSTEM IS DISCUSSED; OPERATING COSTS ARE TABULATED TO SHOW ECONOMY OF PROCESSING RINSING WATER BY ION EXCHANGE SYSTEM. (EI-04603).

01213. ECONOMICS EFFECT OF WATER/POWER RATIOS AND ROLE OF DUAL PROCESS-DUAL PURPOSE PLANTS.

CHAMBERS, S.
NUCLEAR DESALINATION, JT SYMP OCT 30, 1967, HELD AT INST CIV ENG BY BRIT NUCL ENERGY SOC AND BRIT NUCL FORUM. BNES, LONDON, 1968 PAPER, 5 P, 29-39.

EFFECT OF DIFFERENT COSTING PROCEDURES ON TECHNICAL SPECIFICATION OF WATER PLANT IN OPTIMIZED DUAL PURPOSE NUCLEAR MULTISTAGE FLASH DESALINATION PLANT IS GIVEN, TOGETHER WITH CORRESPONDING PRODUCT WATER COSTS; LIMITATIONS TO WATER/POWER RATIO FOR GAS COOLED AND WATER COOLED REACTORS ARE DISCUSSED AND EXTENSION OF RATIO BY COMBINED WORK/HEAT DUAL PROCESS METHODS IS STUDIED; VAPOR COMPRESSION COMBINED WITH MULTISTAGE FLASH DISTILLATION PROMISES FLEXIBILITY AND POTENTIAL ECONOMY ONLY WHEN COMPRESSORS OF LARGE SIZE ARE DEVELOPED. (EI-22091).

01214. DESIGN REQUIREMENTS OF MATERIALS FOR DISTILLATION PLANTS.

STEWART, J.M.
PROC OF CONF, ROLE OF COPPER AND ITS ALLOYS IN DESALINATION EQUIP, DEC 8, 1966, COPPER DEVELOP ASS, LONDON, 1968, PAPER 3, P 21-27.

SOME OF DESIGN CONSIDERATIONS AFFECTING CHOICE OF MATERIAL IN CONSTRUCTION OF DISTILLATION PLANTS ARE GIVEN; IT IS SEEN THAT IN MOST CASES THERE IS COMPROMISE BETWEEN DESIGN CONSIDERATIONS AND COST OF MATERIALS USED IN ORDER TO ARRIVE AT PLANT HAVING MINIMUM CAPITAL OPERATING COST; IDEA BEING TO GIVE PRODUCT WHICH CAN BE COMPETITIVE WITH OTHER MEANS OF OBTAINING PURE WATER. (EI-40790).

01215. DEEP WELLS.

TALBOT, J.S.
CHEM ENG., 75(22), 108-111, 1968.

DEPTHS OF WELLS VARY FROM FEW HUNDRED FEET TO OVER 12,000 FT, WITH CAPACITIES FROM 10 TO 2000 GPM OR MORE; WASTES HANDLED THIS WAY INCLUDE AL-

KALIS, ACIDS, RADIOACTIVE MATERIALS, HIGH BOD STREAMS, CHROMATES, CYANIDES, NITRATES, PHOSPHATES, CHLORIDES AND LIKE; CHARACTER OF WASTE MAY BE LIMITATION TO DEEP WELL DISPOSAL, THOSE WITH LARGE AMOUNTS OF SUSPENDED SOLIDS, OR THOSE THAT ARE UNSTABLE OR INCOMPATIBLE WITH FORMATION ARE USUALLY UNSATISFACTORY FOR INJECTION; DEEP DISPOSALL SYSTEM CONSISTS OF WELL PLUS SURFACE EQUIPMENT SUCH AS TREATERS, TANKS, FILTERS, PUMPS, TRANSFER PIPING AND CONTROLS; WELLS MAY BE INSTALLED FROM LESS THAN 20,000 DOLLARS TO OVER 1,500,000 DOLLARS. (EI).

01216. DEPHENOLIZATION OF WATER AND WASTEWATER.

EISENHAUER, H.R.
WATER & POLLUTION CONTROL, 106(9), 34, 38-41, 1968.

SUMMARY REVIEW OF METHODS USED TO REMOVE PHENOLS FROM WASTE STREAMS AND FOR TREATMENT OF PHENOLIC EFFLUENTS; DATA ON PHENOL REACTIVITY WITH HYPOCHLORITE; OXIDATION SYSTEM COSTS; BIOLOGICAL OXIDIZABILITY OF PHENOLS. (EI-46785).

01217. ECONOMIC PLANNING FOR STAGED DEVELOPMENT.

SORENSEN, K.E.; JACKSON, R.D.
ASCE J HYDRAULICS, 94(H45), PAPER 6114, 1231-1244, 2968.

VARIOUS REASONS FOR STAGED DEVELOPMENT, TYPES THEREOF, ECONOMIC FACTORS INVOLVED, AND CONTEMPORARY ANALYTIC PROCEDURES ARE PRESENTED WITH EXAMPLES OF KNOWN APPLICATIONS TO EVALUATE ECONOMIC MERITS OF WATER PROJECTS. (EI-02522).

01218. SLUDGE DISPOSAL EXPERIENCES AT NORTH LITTLE ROCK, ARKANSAS.

ALFORD, J.M.
J WATER POLLUTION CONTROL FED., 41(2), 175-183, 1969.

USE OF FLUIDIZED SAND BED REACTOR HAS BEEN PROVED EFFECTIVE IN DISPOSAL OF SANITARY SLUDGES FROM PRIMARY TREATMENT PLANT; ADVANTAGES OF LOW SPACE REQUIREMENT, LOW OPERATING COST, AND LOW MAINTENANCE COST SHOULD ENCOURAGE CAREFUL CONSIDERATION OF THIS PROCESS AS ALTERNATE METHOD OF SLUDGE DISPOSAL IN ANY FUTURE INSTALLATION. (EI-31281).

01219. DEEP DOWN WASTE DISPOSAL.

RAMEY, B.J.
MECH ENG., 90(8), 28-31, 1968.

DEEP WELL INJECTION METHOD DISPOSAL OF LARGE VOLUMES OF LIQUID WASTE UNDERGRUND IS DESCRIBED, THAT GAINED ACCEPTANCE AMONG CHEMICAL AND PETROCHEMICAL PROCESSORS; GEOLOGICAL AND OTHER FACTORS INFLUENCING FEASIBILITY OF WELL SYSTEM ARE INDICATED; CONSTRUCTION COSTS ARE DISCUSSED; ADAPTATION OF 'DEEP WELL' CONCEPT IS ILLUSTRATED BY EXAMPLE OF INSTALLATION AT EL PASO PRODUCTS CO, TEXAS, WHERE 40,000 GPD OF WASTE EFFLUENT IS DISCHARGED INTO SUBSURFACE DISPOSAL ZONE; CORROSION PROBLEMS ARE REVIEWED. (EI-47331).

01220. PLATING WASTE TREATMENT--WHICH SYSTEM.

MARTIN, R.W.
PRODUCTS FINISHING, 33(1), 61-66, 68, 70, 1968.

EVALUATION OF THREE SYSTEMS IN COMMON USE, NAMELY CHEMICAL DESTRUCTION, RECOVERY OF SOLUTIONS BY EVAPORATION, AND RECOVERY BY ION EXCHANGE THEIR ADVANTAGES AND DISADVANTAGES; ECONOMICS OF RECOVERY VS DISPOSAL SYSTEMS ARE STUDIED AND EXAMPLE GIVEN; TABLE GIVES FIGURES FOR BOTH CAPITAL AND OPERATING COSTS IN THEORETACAL PLANT; RECOMMENDATIONS ON HOW TO DETERMINE STARTING POINT FOR SYSTEM EVALUATION. (EI-10525).

01221. METAL FINISHING WASTE TREATMENT-COMPARATIVE ECONOMICS.

YURONIS, D.
PLATING, 55(10), 1071-1074, 1968.

VARIOUS TREATMENT METHODS OF DESTRUCTION, EXCHANGE, AND EVAPORATION ARE COMPARED; GENERAL APPLICABILITY OF EACH, WITH RESPECT TO EFFLUENT FLOW RATES, CONCENRATIONS AND OTHER VARIABLES ARE DESCRIBED; SPECIFIC EXAMPLES ARE PRESENTED FOR ECONOMIC ANALYSIS EMPHASIZING FACTORS INVOLVED IN TREATMENT METHOD SELECTIONS. (EI-45588).

01222. ARCTIC HEATED PIPE WATER AND WASTE WATER SYSTEMS.

GRAINGE, J.W.
WATER RESEARCH, 3(1), 47-71, 1969.

SANITATION PROBLEMS OF COMMUNITIES IN CANADIAN NORTH ARE DISCUSSED; ENVIRONMENTAL CONDITIONS ARE EVALUATED; SUGGESTED IMPROVEMENTS IN SANITATION IN SMALL CANADIAN COMMUNITIES BY PROVIDING PIPED WATER AND SEWAGE SERVICES; TWO ORIGINAL, RELATIVELY INEXPENSIVE, ALL-WEATHER SYSTEMS SUITABLE WHERE PIPES MAY NOT BE BURIED ON ACCOUNT OF SOIL CONDITIONS ARE DESCRIBED; ANOTHER SYSTEM DESCRIBED IS SUITABLE FOR SUMMER USE ONLY; IDEAS AND SUGGESTIONS FOR PLANNING WATER AND SEWERAGE SYSTEMS. (EI-23705).

01223. WATER CONSERVATION SAVES $250000.

STEVENS, H.A.
POWER, 112(4), 76-8, 1968.

WATER CONSERVATION METHODS THAT HAVE PROVIDED ECONOMIC ADVANTAGES IN GROUP OF 40 MEAT PACKING PLANTS INCLUDE: AUTOMATIC CONTROL OF JACKET COOLING WATER FOR PUMPS AND COMPRESSORS, REUSE OF JACKET WATER, COOLING TOWER SYSTEMS, CONSERVING CONVEYOR WASH WATER, REUSE OF GREASE SEPARATOR WATER AND AUTOMATIC FILLING OF STOCK WATERING TROUGHS. (EI).

01224. WATER--ITS ECONOMIC REUSE VIA CLOSED CYCLE.

PARTRIDGE, E.P.; PAULSON, E.G.
CHEM ENG. 74(21), 244-8, 1967.

BECAUSE OF STRICTER ANTI POLLUTION REGULATIONS AND FIERCER COMPETITION FOR AVAILABLE FRESH WATER SUPPLIES, CONTAMINATED WATER WILL INCREASINGLY BECOME TOO COSTLY TO THROW AWAY; BUT INDUSTRY IS BEGINNING TO SOLVE THIS PROBLEM

ECONOMICALLY BY MULTIPLE REUSE OF SUCH WATER. (EI).

01225. FREEZING METHOD FOR CONDITIONING ACTIVATED SLUDGE.

KATZ, W.J.; MASON, D.G.
SOUTHERN WATER RESOURCES&POLLUTION CONTROL CONFERENCE, PROC AT DURHAM, NC, APR 6-7 1967 P 119-28.

THE WORK DESCRIBED IN THE STUDY INDICATED THAT DEWATERING OF THE FREEZE CONDITIONED SLUDGE COULD BE ACCOMPLISHED BY GRAVITY DRAINAGE THROUGH A SCREEN (40 TO 80 MESH) AND MECHANICAL PRESSING OF THE RESULTING SLUDGE CAKE. PROCEDURE ELIMINATES HIGH COST OF VACUUM FILTER EQUIPMENT AND THE FILTER MEDIA BINDING PROBLEM. THE STUDY WAS INITIATED TO INVESTIGATE THE DEWATERING CHARACTERISTICS AND TO EXPLAIN SIGNIFICANT INCREASE IN THE DEWATERING RATES OF FREEZE CONDITIONED ACTIVATED SLUDGE. (EI-21314).

01226. CONTRIBUTION OF INPLANT CONTROLS AND PROCESS MODIFICATIONS TO POLLUTION ABATEMENT IN THE PULPING INDUSTRY.

KLEPPE, P.J.
SOUTHERN WATER RESOURCES&POLLUTION CONTROL CONFERENCE, PROC AT RALEIGH, NC, APR 9-10 1969, P 85-100.

ATTEMPTS MADE TO MINIMIZE THE POLLUTION ABATEMENT COST AT THE DESIRED PRODUCTION CAPACITY BY SELECTING THE OPTIMUM ECONOMICAL COMBINATION OF INPLANT CONTROLS AND/OR PROCESS MODIFICATIONS AND TREATMENTS OF THE WASTE TO MEET REQUIRED STANDARDS ARE DISCUSSED. THE DIFFERENT PROCESSES, THE TYPES OF POLLUTANTS AND THEIR FORMATION, AND THE DEGREE TO WHICH POLLUTION CAN BE PREVENTED, ARE DESCRIBED. STATUS AND TRENDS IN POLLUTION ABATEMENT. (EI-24895).

01227. REMOVING HARDNESS FROM BRACKISH WATERS.

FRADKIN, A.M.; SELBY, K.A.
INDUS WATER ENG. 6(5), 32-34, 1969.

ONCE THE TDS OF THE FEEDWATER BEGINS TO EXCEED 5000 MG/L, AN ALL SALT ION EXCHANGE SYSTEM CANNOT REDUCE THE FINAL HARDNESS LEAKAGE TO 1 MG/L. SO, FOR THE 10,000 MG/L AND HIGHER FEEDWATER, ONLY THE CHELATING RESIN SYSTEM I[illegible]ASIBLE, WHEN THE TDS LEVEL REACHES 10,000 MG/L (1[illegible]0 MG/L TH), ABOUT 60% OF CHEMICAL COST IS FOR SALT, 40% FOR ACID AND CAUSTIC. DOUBLING THE TDS LEVEL INCREASES CHEMICAL COSTS 2.7 TIMES, ABOUT HALF OF WHICH IS FOR SALT, HALF FOR HYDROCHLORIC ACID AND SODIUM HYDROXIDE. (EI-22520).

01228. PHOSPHORUS REMOVAL. PAST, PRESENT, AND FUTURE.

HALL, M.W.; ENGLEBRECHT, R.S.
WATER & WASTES ENG 6(8), 50-53, 1969.

REVIEW OF PUBLICATIONS ON METHODS USED AND DEVELOPED. FLOW DIAGRAMS OF PROPOSED CHEMICAL BIOLOGICAL PHOSPHORUS REMOVAL PROCESS AND OF LIME TREATMENT PHOSPHORUS REMOVAL PROCESS. DATA ON COMPARISON OF ALTERNATIVE PHOSPHORUS REMOVAL METHODS. (EI-22594).

01229. SYSTEMS ANALYSIS AND OPTIMIZATION OF DUAL PURPOSE NUCLEAR POWER AND DESALTING PLANTS.

FAN, L.T.; HWANG, C.L.; PEREIRA, N.C.; ERICKSON, L.E.; CHENG, C.Y.
KANSAS STATE UNIV INSTITUTE FOR SYSTEMS DESIGN & OPTIMIZATION - REPORT 16 APR 12 1969, 88 P.

THE PURPOSE OF THIS REPORT IS TO PRESENT RESULTS OF THE ANALYSIS AND OPTIMIZATION OF A DUAL PURPOSE PLANT. THE TOTAL COST OF THE SYSTEM FOR PRODUCING DIFFERENT LEVELS OF POWER AND WATER DEMAND IS MINIMIZED. THE OPTIMAL COST OF WATER IS DETERMINED AFTER ACCOUNTING FOR INCOME FROM POWER SALE. IT HAS BEEN FOUND THAT THE MATHEMATICAL MODEL REPRESENTING THE OVERALL SYSTEM HAS FIVE DEGREES OF FREEDOM. PRIOR TO CARRYING OUT THE OPTIMIZATION STUDY, SEVERAL TWO DIMENSIONAL SIMULATIONS OF THE SYSTEM HAVE BEEN PERFORMED. THE FINAL OPTIMIZATION OF THE OVERALL COST INVOLVES A FOUR DIMENSIONAL SEARCH CARRIED OUT BY THE SEQUENTIAL SIMPLEX PATTERN SEARCH TECHNIQUE. (EI-22559).

01230. TERTIARY TREATMENT OF KRAFT MILL EFFLUENT INCLUDING CHEMICAL COAGULATION FOR COLOR REMOVAL.

DAVIS, C.L. JR.
TAPPI 52(11), 2132-2134, 1969.

THE DEGREE OF CHEMICAL TREATMENT IS DEFINED IN TERMS OF COLOR UNITS AND IS LIMITED TO 30 PPM WITH A MAXIMUM WASTE DISCHARGE OF 10 MILLION GPD. BIOCHEMICAL OXYGEN DEMAND, FIVE-DAY, IS LIMITED TO 800 LB/DAY, AND SUSPENDED SOLIDS ARE LIMITED TO 10 PPM. A TREATMENT SYSTEM TO MEET THESE REQUIREMENTS WAS PUT INTO OPERATION IN MAR 1968. THE PROCESS IS DESCRIBED AND AN INTERIM REPORT OF OPERATING RESULTS AND COSTS IS GIVEN. (EI-27952).

01231. COST ANALYSIS OF LARGE EVAPORATIVE TYPE COOLING TOWERS.

CHATFIELD, D.L.; STREETON, D.F.
KERNTECHNIK 11(11), 679-652, 1969.

A METHOD IS GIVEN FOR PREDICTING THE COSTS OF LARGE EVAPORATIVE TYPE NATURAL AND MECHANICAL DRAFT COOLING TOWERS AS FUNCTIONS OF THE MAIN DESIGN PARAMETERS. THE COSTS AND PARAMETER FACTORS ARE ALSO EXPRESSED ANALYTICALLY FOR USE IN POWER PLANT OPTIMIZATION PROGRAMS. (EI-30201).

01232. EXTENSIONS TO THE CHANIA. SASUMUA, WATER SUPPLY SCHEME FOR NAIROBI.

DIXON, H.H.; BERRY, D.W.
INSTN CIV ENGRS - PROC 45 1970 P 35-64.

THE KIBURU RIVER WAS DIVERTED AND THE SASUMUA DAM WAS RAISED TO PROVIDE ADDITIONAL STORAGE. A NEW METHOD WAS DEVELOPED TO DEAL WITH THE RALATIVELY HIGH RATIO OF HORIZONTAL TO VERTICAL LOADING. DETAILS ARE GIVEN OF THE VIRTUAL MASS ANALYSIS USED FOR THE VALVE TOWER AND ACCESS BRIDGE PIERS. TO IMPROVE THE STABILITY OF THE RAISED VALVE TOWER, IT WAS NECESSARY TO LOWER THE WATER LEVEL IN THE RESORVOIR. THE METHOD USED TO DETERMINE THE MOST ECONOMICAL COMBINATION OF INTAKE RESERVOIR CAPACITY AND PIPE LINE SIZE TO DIVERT KIBURU RIVER INTO SASUMUA RESERVOIR IS DESCRIBED. (EI-30640).

REFERENCE LIST

01233. EXTERNAL CORROSION OF BURIED FERROUS PIPELINES.

HOSFORD, H.W.
WATER & WASTES ENG. 6(11), 95, 1969.

THE IMPORTANCE OF THE ENVIRONMENT IN THE CORROSION OF BURIED PIPE IS EMPHASIZED IN DISCUSSION OF SOIL TYPES AND PROPERTIES, GALVANIC AND ELECTROLYTIC MECHANISMS OF CORROSION, AND VARIATIONS IN PIPE LINE MATERIALS AND CONSTRUCTION. MATERIAL THICKNESS, COATINGS AND RELATIVE COSTS OF PROTECTING FORM TYPES OF BURIED PIPE LINES ARE DISCUSSED IN CONNECTION WITH USE OF METHODS OF CATHODIC PROTECTION. (EI-26805).

01234. TREATMENT OF HIGH NITRATE WATERS.

ST AMANT, P.P.; MCCARTY, P.L.
AWWA-J 61(12), 1969.

A NEW PROCESS FOR REMOVING EXCESSIVE NITRATES FROM WATERS DESCRIBED CONSISTS OF AN ANAEROBIC FILTER IN WHICH BACTERIAL DENITRIFICATION IS ENCOURAGED. SUMMARY OF THE PILOT PLANT STUDIES WHICH WERE CONDUCTED TO ESTIMATE CHEMICAL REQUIREMENTS, EVALUATE POSSIBLE FILTER MEDIA, AND DETERMINE THE PROCESS DESIGN AND COST.

01235. ROLE OF EVAPORATION IN ECONOMICS OF WASTE TREATMENT FOR PLATING OPERATIONS.

CULOTTA, J.M.; SWANTON, W.F.
PLATING, 55(9), 957-961, 1968.

DISCUSSION AND ANALYSIS OF RECOVERY OF PLATING CHEMICALS FROM RINSE WATER UTILIZING EVAPORATION ARE PRESENTED; EFFECT OF COUNTER CURRENT RINSING IS EXPLAINED; METHODS FOR ACHIEVING FULLY OR PARTIALLY CLOSED LOOP OPERATIONS ARE DESCRIBED; RELATIVE ECONOMICS OF EVAPORATIVE RECOVERY COMPARED TO CHEMICAL DESTRUCTION IS QUANTITATIVELY DISCUSSED; IT IS SHOWN THAT RELATIVELY SMALL EVAPORATOR CAN RECOVER OVER 99% OF DRAGOUT CHEMICALS AND THAT CLOSED LOOP OPERATION AND ADEQUATE RINSING CAN BE ACHIEVED WITH SMALL ION EXCHANGER ON LAST RINSE. (EI).

01236. WHAT OPTIONS DO PLATERS HAVE IN POLLUTION CONTROL.

IRON AGE, 201(24), 76-78, 1968.

TWO BASIC QUESTIONS IN CONTROL OF PLATING WASTES ARE SELECTION OF SYSTEM, AND ITS CAPITAL AND OPERATING COSTS; FIVE FACTORS TO CONSIDER BEFORE DECIDING WHETHER TO RECOVERY, OR DISPOSE OF CHEMICALS AND WATER; TABLE PROVIDES FIGURES FOR BOTH CAPITAL AND OPERATING COSTS IN THEORETICAL PLANT WITH RINSE RATE OF 100 GPM CONTAINING 40 PPM OF CHRONIC ACID (CRO3) IN ADDITION TO PLATING BATH DUMPS. (EI).

01237. SYSTEMS ANALYSIS OF THE ASSIMILATIVE CAPACITY OF STREAMS.

THOMANN, R.V.
DELAWARE ESTUARY COMPREHENSIVE STUDY, PROCEEDINGS OF THE SECOND ANNUAL WATER QUALITY RESEARCH SYMPOSIUM, ALBANY, NEW YORK, 1970.

01238. INDUSTRIAL WASTE TREATMENT BY PRESSURE FILTRATION.

MCGIBBON, V.R.
IRON & STEEL ENGER, 45(4), 93-96, 1968.

TESTING PROGRAM HAS SHOWN THAT DEEP BED PRESSURE FILTRATION WILL PRODUCE SATISFACTORY EFFLUENT FOR SECONDARY TREATMENT OF PLATE MILL WASTE WATERS; FILTERS MUST INCORPORATE BACKWASH CYCLE THAT EFFECTIVELY OVERCOMES MEDIA CLOGGING TENDENCY INHERENT IN PLATE MILL WASTES; IT IS CONCLUDED THAT FILTERS ARE BENEFICIAL IN LOWERING CAPITAL COSTS, LOWER OPERATING COSTS AND LESS LAND REQUIREMENTS WHEN COMPARED TO CONVENTIONAL METHODS. (EI).

01239. LEGAL AND TECHNICAL ASPECTS OF PROCESS WASTE MANAGEMENT.

EVANS, R.R.
A.I.CH.E. WORKSHOP-INDUS PROCESS DESIGN FOR POLLUTION CONTROL, V 1, FEB 9-10, 1967, P 1-5.

SURVEY INCLUDES INCONSISTENT LAW DECISIONS, PUBLIC LAW 234, CLEAN RIVERS RESTORATION ACT, ABATEMENT AT SOURCE, AND INCREMENTAL COSTS; WASTE EMISSION VOLUMES OR CONCENTRATIONS CAN BE REDUCED OR ELIMINATED BY PROCESS CHANGE, PROCESS MODIFICATION, WATER REUSE, BY PRODUCT RECOVERY, AND GOOD HOUSEKEEPING. (EI).

01240. POLLUTION PROGRAM PAYS ITS WAY.

IRON AGE, 201(N4), 81-82, 1968.

AT FORD CLEVELAND ENGINE PLANT COMPLEX, UTILIZATION OF OIL FROM WASTEWATER EFFLUENT WAS CONVERTED TO ASSET, WITH ONE OF ADVANTAGES BEING CASH SAVING OF ABOUT 100,000 DOLLARS IN FIRST YEAR. OIL DISCHARGED FROM MACHINING OPERATIONS, CONSTITUTING ABOUT 3% OF TOTAL WASTE EFFLUENT, IS DRAWN OFF WASTE THROUGH USE OF SKIMMERS; SKIMMED PRODUCTS ARE DE-EMULSIFIED IN HOLDING TANK UNTIL WATER AND OIL ARE SEPARATED; AFTER SETTLING, OIL IS TRANSFERRED TO HOLDING TANKS AND USED AS EMULSIFIABLE OIL IN CUTTING AND GRINDING APPLICATIONS. (EI).

01241. TECHNIQUES FOR DECONTAMINATION OF OIL FIELD CRUDE WATERS. (IN GERMAN).

ROENNEKE, H.
ERDOEL U KOHLE-ERDGAS-PETROCHEMIE, 21(3), 137-140, 1968.

BASED ON BASIC RESEARCH INTO PHENOMENON (FLOTATION) AND EXTENSIVE INDUSTRIAL TESTS, PROCESS WAS DEVELOPED FOR COMPLETE SEPARATION OF OIL IN WATER EMULSIONS BY MEANS OF AIR INJECTION; ODOR AND TASTE OF PURIFIED WATER CAN BE RESTORED WITHOUT FURTHER PURIFICATION USING FILTERS, FLOCCULATION, SORBENTS OR EXTRACTION AGENTS, NO DEPOSITS OR SLUDGES OCCUR, AND OPERATING COSTS ARE LOWER; PROCESS PRINCIPLES, PLANT PERFORMANCE DATA, AND OPERATING COSTS, IN COMPARISON WITH CONVENTIONAL METHODS ARE GIVEN. IN GERMAN WITH ENGLISH ABSTRACT. (EI).

01242. MINE WATER RESEARCH. PLANT DESIGN AND COST ESTIMATES FOR LIMESTONE TREATMENT.

MIHOK, E.A.
U.S. BUR MINES, REP INVEST 7368, APR 1970, 13 P.

PAPER PRESENTS PLANT DESIGN AND COST ESTIMATES FOR LIMESTONE TREATMENT OF ACID MINE WATER COVERING A WIDE RANGE OF QUALITY AND QUANTITY CONDITIONS. THE TREATMENT PROCESS CONSISTS OF LIMESTONE NEUTRALIZATION, AERATION, SOLIDS SETTLING, AND CONCENTRATION. THE DESIGN CRITERIA FOR THE VARIOUS OPERATION FUNCTIONS ARE BASED ON PILOT PLANT PERFORMANCE, LABORATORY DATA, AND ESTABLISHED MINE WATER TREATMENT STANDARDS. UNIT COSTS HAVE BEEN ASSUMED AND ARE RELATED TO GENERAL MARKET PRICES AND CONDITIONS. THESE ESTIMATES SERVE AS PRELIMINARY INDICATORS OF WHAT IT WOULD COST TO CONSTRUCT AND OPERATE A MINE WATER TREATMENT PLANT. (EI-35258).

01243. MAKE PLANT REFUSE PROFITABLE.

SCHROERING, J.B.
PLANT ENG., 24(1) 65-67, 1970.

INCINERATION OR DEEP WELL DISPOSAL IS THE MOST STRAIGHTFORWARD AND, THEREFORE, THE MOST ECONOMICAL MEANS OF DISPOSAL. USE OF EITHER SYSTEM MAY DISREGARD THE ECONOMIC VALUE OF RECOVERING COMPONENTS OF THE WASTE FOR REUSE OR SALE THROUGHA REPROCESSING TECHNIQUE. A REPROCESSING SYSTEM MIGHT COST MANY TIMES AS MUCH AS THE DIRECT DISPOSAL OF THE WASTE, BUT THE ULTIMATE VALUE OF A RECOVERED PRODUCT COULD PROVE THIS APPROACH THE MOST ECONOMICAL SOLUTION. (EI-32250).

01244. BIODEGRADABILITY AND TREATABILITY OF COMBINED NYLON AND MUNICIPAL WASTES.

POON, C.P.C.
WATER POLLUTION CONTROL FEDERATION J., 42(1), 100-105, 1970.

01245. SEWERAGE AND SEWAGE TREATMENT. STATE OF THE ART ABSTRACTS. *01 01246 DESALINATION PROCESSES AND COSTS.

BAHARI, E.
CHEM & PROCESS ENG., 50(3), 71-75, 1969.

THE PROSPECT OF REVITALIZING THE SEMI-DESERT REGIONS OF THE WORLD TOGETHER WITH THE PROBLEM OF A FUTURE WATER SHORTAGE IN DEVELOPED COUNTRIES HAS LED TO CONSIDER RESEARCH INTO DESALINATION PROCESSES. IN THIS ARTICLE THE IMPORTANT ONES ARE REVIEWED: DISTILLATION METHODS, FREEZING, ELECTRODIALYSIS AND PROCESS COSTS SET OUT. TO BRING WATER COSTS DOWN TO THOSE FOR NATURAL WATER SOURCES, IT IS ENVISAGED THAT IN THE FUTURE ATOMIC ENERGY WILL BE HARNESSED TO HUGE DESALINATION PLANTS OF AROUND 50 MILLION GPD CAPACITY. (EI-25269).

01247. ECONOMIC ASPECTS OF RECOVERY OF MINERALS FROM EFFLUENTS.

TEWORTE, W.
CHEM AND INDUSTRY (LONDON), MAY 3, 1969, P 565-74.

TABLE LISTS A PARTIAL SURVEY OF CURRENT BYPRODUCTS, MOSTLY RECOVERED FROM AQUEOUS SOLUTIONS. ONLY A LIMITED NUMBER OF THESE PRODUCTS CAN BE RECOVERED AT A PROFIT OR BREAK EVEN LEVEL. OF THE REMAINDER, THE LOSS MUST BE BORNE BY THE MAIN PRODUCT OR BY THE EFFLUENT TREATMENT COST OF OTHER PRODUCTS. ON THE OTHER HAND, WE MUST SEE EFFLUENT PURIFICATION NOT ONLY AS AN END IN ITSELF, BUT ALSO IN COMBINATION WITH OBJECTIVE NEEDS. THAT IS, THE EFFLUENT FROM A CHEMICAL PLANT CANNOT BE PURIFIED AS PURE AS TECHNICALLY POSSIBLE WITHOUT CONSIDERATION OF THE COST, BUT MUST TAKE INTO CONSIDERATION THE CONDITION OF THE MAIN DRAIN OF THE CHEMICAL PLANT AND BE AS PURE AS IS NECESSARY FOR THE CURRENT REQUIREMENT. DATA AND FLOWSHEETS FOR SEVERAL PROCESSES ARE INCLUDED. (EI-38167).

01248. REVERSE OSMOSIS FOR INDUSTRIAL WATER AND WASTE TREATMENT.

MYERS, J.H.
ASME PAPER 70-PEM-21 FOR MEETING, MARCH 16-18, 1970, 8P.

THE RAPID ADVANCE OF REVERSE OSMOSIS FOR INDUSTRIAL WATER AND WASTE PROCESSING IS DISCUSSED. EMPHASIS IS ON EQUIPMENT PERFORMANCE. (EI).

01249. OPTIMAL RESERVOIR RELEASES FOR WATER QUALITY CONTROL.

JAWORSKI, N.A.; WEBER, W.J.JR; DEININGER, R.A.
ASCE J SANIT ENG DIV., 69(SA3), PAPER 7361, 727-742, 1970.

A GENERAL MATHEMATICAL MODEL FOR DETERMINING OPTIMAL FLOW RELEASE SEQUENCES FOR WATER QUALITY CONTROL FROM MULTIPLE RESERVOIR SYSTEMS IS PRESENTED. THE MODEL DEFINES AN OPTIMAL RELEASE SEQUENCE WHICH PROVIDES EITHER THE BEST QUALITY OF WATER OR THE LEAST COST OF RESERVOIR STORAGE FOR A GIVEN STREAM FLOW AT A PARTICULAR POINT IN THE SYSTEM. THE FLOW RELEASE MODEL INCORPORATES FORMULATIONS FOR BOD, DO, TEMPERATURE, AND PHYSICAL RELATIONSHIPS FOR STREAM FLOW VELOCITY AND DEPTH. (EI-38979).

01250. EVALUATION OF ANAEROBIC DENITRIFICATION PROCESSES.

SEIDEL, D.F.; CRITES, R.W.
ASCE J SANIT ENG DIV., 96(SA2), PAPER 7211, 267-277, 1970.

NITRIFIED MUNICIPAL WASTEWATER EFFLUENT WAS PASSED UPWARD THROUGH AN ANAEROBIC FILTER CONTAINING GRAVEL MEDIA TO EFFECT DENITRIFICATION USING MATHANOL AS A SUPPLEMENTARY CARBON SOURCE FOR THE DENITRIFYING BACTERIA, 90% NITROGEN REMOVAL WAS OBTAINED. THE ADVANTAGES OF ANAEROBIC FILTER PROCESS OVER OTHER METHODS OF DENITRIFICATION ARE LOW INITIAL AND OPERATING COST, SIMPLICITY OF OPERATION, LONG SOLIDS RETENTION TIMES, AND ABSENCE OF ANY SLUDGE RECYCLE OR DISPOSAL EQUIPMENT. THE MAJOR OPERATING COST FOR THE PROCESS IS FOR THE METHANOL. THE QUANTITY REQUIRED INCREASES WITH INCREASING DISSOLVED OXYGEN AND NITRATE NITROGEN AND DECREASING EFFLUENT BOD. (EI-38140).

REFERENCE LIST

01251. TOTAL DOLLAR BENEFIT OF WATER POLLUTION CONTROL.

NEMEROW, N.L.; FARO, R.C.
ASCE J. SANIT ENG DIV., 96(SA3), PAPER 7323, 665-674, 1970.

HOW TANGIBLE DOLLAR BENEFITS OF A LAKE OR STREAM AT A GIVEN WATER QUALITY MAY BE ESTIMATED BY DETERMINING ALL USES WHICH BOTH AFFECT AND ARE AFFECTED BY WATER QUALITY, BY INDEPENDENTLY VALUING EACH USE, AND BY SUMMING THE RESULTANT VALUES. MEASURABLE BENEFICIAL WATER USES RELATED TO WATER QUALITY INCLUDE RECREATIONAL USES, WITHDRAWAL WATER USES, WASTEWATER DISPOSAL USES, BORDERING LAND USES AND IN-STREAM WATER USES. APPLICATION OF THE METHOD TO ONONDAGA LAKE AT SYRACUSE, NEW YORK, IS GIVEN. (EI-39128).

01252. STEAM GENERATING HEAVY WATER REACTOR IN DUAL PURPOSE APPLICATIONS.

CHAMBERS, S.
PROC OF SYMP BY IAEA, NOV 18-22 1968, MADRID, SPAIN IAEA, 1969 PAP SM113/45 P 331-40.

IN VIEW OF THE STATE OF DEVELOPMENT OF MULTISTAGE FLASH (MSF) EVAPORATION PLANT, AND THE DOUBTFUL ADVANTAGE OF INCREASING THE MAXIMUM BRINE TEMPERATURE, IT IS ARGUED THAT FOR SOME YEARS TO COME COMMERCIAL PLANTS WILL NOT EXCEED 12 MGD, NOR WILL THE MAXIMUM BRINE TEMPERATURE EXCEED 240 F. A STUDY HAS BEEN MADE OF THE BASE LOAD SGHWR-MSF EVAPORATION SYSTEM OVER A RANGE OF WATER OUTPUTS FROM 100 TO 400 MW. OPTIMIZATION HAS BEEN CARRIED OUT ON THE BASIS ONF MINIMUM TOTAL OPERATING COST, BUT, TO DERIVE THE WATER COST, AN ELECTRICITY CREDIT APPROPRIATE TO THEEQUIVALENT SINGLE PURPOSE POWER STATION HAS BEEN ALLOWED. COST CONTOURS ARE DRAWN THEREFORE, FOR PLANT COMBINATIONS WHICH COULD BE BUILT WITH CONFIDENCE ON CURRENT TECHNOLOGY, AGAINST WATER PRODUCTION AND ELECTRICAL OUTPUT FOR A RANGE OF CAPITAL CHARGE RATES AND LOAD FACTORS.

01253. CONCEPTUAL DESIGN STUDY OF A 250 MILLION GALLONS PER DAY COMBINED VERTICAL TUBE FLASH EVAPORATOR DESALINATION PLANT.

HAMMOND, R.P.; HUNTER, J.A.; SIEDER, E.N.; TOMALIN, P.G.
U.S. OFFICE SALINE WATER, RES DEVELOP PROGR REP 391 AUG 1968, 191 P.

THE OAK RIDGE NAT LABORATORY HAS DESIGNED A DESALTING PLANT COMBINING A MULTISTAGE FLASH (MSF) FEED HEATER WITH VERTICAL EVAPORATOR EFFECTS IN WHICH TUBES WITH FLUTED SURFACES ARE USED TO OBTAIN HEAT TRANSFER PERFORMANCE SIGNIFICANTLY HIGHER THAN THOSE USUALLY OBTAINED WITH SMOOTH TUBES. (EI-18116).

01254. SOCIO-ECONOMIC CONSIDERATIONS IN EXPLOITING RESOURCES AND ENHANCING THE QUALITY OF THE OCEAN ENVIRONMENT.

JOHNSON, M.G.
MARINE GEODESY, A PRACTICAL VIEW. 2ND SYMP NOV 3-5 1969, NEW ORLEANS, LA. MAR TECHNOL SOC, MAR GEOD COMM. 1970. 165-8. (EI-17100.

01255. WHY PAY TWICE. SALVAGE YOUR WASTE.

GURNHAM, C.F.
AICHE PAPER AT 63RD ANNUAL MEETING, CHICAGO, ILLINOIS, NOVEMBER 29-DECEMBER 3, 1970, 8 P.

POLLUTION CONTROL IS NOW CONSIDERED AN INTEGRAL PART OF THE PRODUCTION PROCESS. THE COST OF TREATING MATERIALS LOST TO AN INDUSTRIAL WASTE STREAM AS POLLUTANTS MUST BE CONSIDERED A SECOND PURCHASE PRICE. BUT FOR THOSE INDUSTRIES THAT ADOPT THE MATERIAL CONSERVATION APPROACH, THE BENEFITS OF SUCH A PROGRAM CAN OUTWEIGH THE COSTS OF TREATMENT. (EI-16240).

01256. TOOLS FOR WATER RESOURCE STUDY.

DAWES, J.H.
ASCE J IRRIG DRAIN DIV., 69(IR4), PAPER 7720, 403-424, 1970.

THE ILLINOIS STATE WATER SURVEY IS DEVELOPING A WATER RESOURCE MODEL TO EXAMINE THE ALTERNATIVE SOLUTIONS TO MEET THE OBJECTIVES DETERMINED BY ECONOMIC, SOCIAL AND POLITICAL CRITERIA. SUBROUTINES ESTIMATE COSTS FOR RESERVOIRS, WATER TRANSMITTING WELLS, PUMPS, MUNICIPAL SEWAGE TREATMENT AND WATER PUMPING. COSTS FOR RESERVOIRS INCLUDE LAND CLEARING, DAM AND SPILLWAY CONSTRUCTION, RELOCATIONS, ENGINEERING SERVICES, CONTINGENCIES, AND LAND. OTHER CONSTRUCTION COSTS OF WELLS, PUMPS AND SEWAGE TREATMENT PLANTS ARE ALSO DISCUSSED. (EI-22693).

01257. THERMOSORB PROCESS FOR DESALTING WATER.

VENOLIA, A.W.; WONG, C.M.; GILLAM, W.S.; JOHNSON, S.; HOROWITZ, R.H.
U.S. OFFICE SALINE WATER, RES DEVELOP PROGR REP 502 DEC 1969, 67 P.

THERMALLY CYCLED CARBON BEDS WERE SHOWN TO BE CAPABLE OF DESALTING AQUEOUS SODIUM CHLORIDE IN A REPRODUCIBLE WAY. INEXPENSIVE RAW MATERIALS, STRAIGHTFORWARD PREPARATIVE METHODS AND MODERATE TEMPERATURES WERE USED. RATES WERE FAVORABLE AND THEY WERE CAPABLE OF BEING MANIPULATED; RATE OPTIMIZATION WAS NOT ATTEMPTED. NO EVIDENCE OF A DURABILITY PROBLEM WAS ENCOUNTERED IN AN UNINTERRUPTED DESALTING RUN OF MORE THAN TWO THOUSAND HOURS DURATION. BEDS OF SALT SORPTIVE CARBONS APPEAR TO BE COMPETITIVE AND BEDS OF ION EXCHANGE RESINS ON THE BASIS OF EFFECTIVE CAPACITY PER WEIGHT OF SORBENT. IT APPEARS LIKELY THAT CARBONS WILL ALSO OUTPERFORM ION EXCHANGE RESINS ON THE BASIS OF INITIAL COST AND DURABILITY. (EI-21135.

01258. INVESTIGATION OF MULTISTAGE FLASH PHENOMENA IN A THREE STAGE TEST SYSTEM.

WILLIAMSON, W.R.; GILBERT, F.W.; WONG, C.M.; SIEDER, E.N.
U.S. OFFICE SALINE WATER, RES DEVELOP PROGR REP 525 JAN 1970, 117 P.

TO ARRIVE AT A BETTER UNDERSTANDING OF THE BEHAVIOR OF A FLASH STAGE BETWEEN ACTIVE FLASHING STAGE, THE NTH STAGE IN A MULTISTAGE PROCESS, THE TEST EQUIPMENT SHOULD ANALYZE THE BEHAVIOR OF A FLASH STAGE BETWEEN TWO ACTIVE STAGES. THIS PRESENT STUDY ARRIVES AT A MORE TYPICAL VIEW OF A

FLASH STAGE, PARTICULARLY AT THE LOWER TEMPERATURE END OF THE PROCESS AND MAY PROVE VALUABLE IN DETERMINING THE ECONOMIC OPTIMUM NUMBER OF STAGES FOR A LARGE DESALINATION PLANT. (EI-21378).

01259. A NEW DESALTING PROCESS UTILIZES RECOVERABLE SOLID REGENERANT ION EXCHANGE.

POPPER, K.
WATER WASTES ENG., 7(4), 61-63, 1970.

IN PROCESS DESCRIBED, SALINE WATER FLOWS ACROSS A CATION EXCHANGER IN THE SODIUM AND CALCIUM FORM AND ITS MAGNESIUM CONTENT IS REMOVED. THE DISSOLVED LIME IS REMOVED FROM THE PRODUCT WATER BY THE EXCHANGE OF THE CALCIUM FOR MAGNESIUM WITH THE FORMATION OF INSOLUBLE MAGNESIUM HYDROXIDE. INVESTMENT AND PRODUCTION COSTS ARE GIVEN. (EI-21962).

01260. ENGINEERING AND ECONOMIC EVALUATION STUDY OF REVERSE OSMOSIS.

HARRIS, F.L.; HUMPHREYS, G.B.; ISAKARI, H.; REYNOLDS, G.; WONG, C.M.; SAVAGE, W.F.; CHANNABASAPPA, K.C.
U.S. OFFICE SALINE WATER, RES DEVELOP PROGR REP 509 DEC 1969, 505 P.

A PARAMETRIC ENGINEERING AND ECONOMIC ANALYSIS OF THE REVERSE OSMOSIS PROCESS WAS PERFORMED IN WHICH WATER COSTS WERE EXAMINED FOR DEMINERALIZING FEEDWATERS WITH SALINITIES OF 200, 3000 AND 5000 PPM IN PLANT SIZE OF 1, 10 AND 50 MGD CAPACITY, PRODUCT WATER RECOVERIES OF 50, 60 AND 80%, AND OPERATING PRESSURES OF 400, 600 AND 800 PSI. CAPITAL AND OPERATING COSTS WERE PREPARED USING STATE OF THHE ART TECHNOLOGY FOR TUBULAR, PLATE AND FRAME, SPIRAL WOUND, AND HOLLOW FINE FIBER REVERSE OSMOSIS PLANT DESIGN CONCEPTS. (EI-20841).

01261. DONNAN SOFTENING AS A PRETREATMENT TO DESALINATION PROCESSES.

EISENMANN, J.L.; SMITH, J.D.; WONG, C.M.; GILLAM, W.S.; PODALL, H.E.; KINDLEY, L.M.
U S OFFICE SALINE WATER, RES DEVELOP PROGR REP 506 FEB 1970, 73 P.

DONNAN MEMBRANE WATER SOFTENING IS A TECHNIQUE DEVELOPED WHICH EXPLOITS THE EXCLUSION PROPERTIES OF ION EXCHANGE MEMBRANES SELECTIVELY TO REMOVE BIVALENT HARDNESS IONS FROM THE FEED WATERS TO DESALINATION SYSTEMS. THE REMOVAL OF SCALE FORMING CALCIUM AND/OR MAGNESIUM IONS FROM THESE FEED WATERS THEREBY ENABLES THE DESALTING PLANT TO OPERATE MORE EFFICIENTLY AND RESULTS IN SUFFICIENT OVERALL COST REDUCTIONS NOT ONLY TO JUSTIFY THE EXPENSE AND COMPLEXITY OF THE ADDITIONAL PROCESS BUT TO PRODUCE LOWER COST WATER. (EI-20861).

01262. MARINE DISPOSAL OF SOLID WASTES.

GUNNERSON, G.; BROWN, R.P.; SMITH, D.D.
ASCE J SANIT ENG DIV., 96(SA6), PAPER 7769, 1387-1397, 1970.

TAKING INTO ACCOUNT THAT IN 1968 APPROXIMATELY 48,000,000 TONS OF WASTES FROM THE CIVILIAN SECTOR WERE DISPOSED IN U. S. COASTAL WATERS AT AN ESTIMATED COST OF 29 MILLION DOLLARS BY TUG AND BARGE OPERATIONS, THE AUTHORS POINT OUT TO INCREASING AMOUNTS IN THE FUTURE AND INDICATE THAT THERE ARE CRITICAL NEEDS FOR BASELINE ENVIRONMENTAL DATA, ADEQUATE MONITORING SYSTEMS, AND ESTABLISHMENT OF RESPONSIBILITY FOR REGULATING DISCHARGES OF SOLID CONTAINERIZED WASTES AT SEA. (EI-22663).

01263. INFILTRATION IN SEPARATE SANITARY SEWERS. DETERMINATION, ECONOMIC COST, AND CORRECTION METHODS.

RIDDLE, V.G.
J WATER POLLUT CONTR FED., 62(9), 1676-1683, 1970.

THE PAPER REPORTS OF A 2 YR SURVEY IN THE MATTER OF ELIMINATING INFILTRATION AND STORM WATER IN SEWER SYSTEMS IN WESTERN MISSOURI AND EASTERN KANSAS SYSTEMS. A SUMMARY IS PRESENTED TO DESCRIBE THE NATURE OF THE INFILTRATION AND STORM WATER PROBLEM. COST DATA ARE PRESENTED THAT SHOW THE RELATIVE EXPENSE OF HANDLING WET WEATHER FLOW VS DRY WEATHER FLOW DETERMINING INFILTRATION. TECHNIQUES DISCUSSED INCLUDE COLOR SLIDES, LOW PRESSURE AIR TESTING, TELEVISION, AND AUDIO PROCESS THAT DETECTS ACTIVE LEAKS, SMOKE TESTING, AND INDIRECT METHODS. INFILTRATION REMEDIES ARE PRESENTED. (EI-23051).

01264. OPTIMIZING AN ACTIVATED CARBON WASTEWATER TREATMENT PLANT.

COVER, A.E.; WOOD, C.D.
IND WATER ENG., 7(4), 21-23, 1970.

SEVERAL DESIGN VARIABLES ARE EXAMINED THAT AFFECT THE OPERATING AND CAPITAL COST OF A TERTIARY WASTEWATER TREATMENT PLANT EMPLOYING GRANULAR ACTIVATED CARBON. THE VARIABLES DISCUSSEC INCLUDE PLANT SIZE, CONTRACTOR SYSTEM, FLOW VELOCITY, VELOCITY IN COMBINATION WITH CONTACT TIME, ADSORBENT COST, REGENERATION LOSS, AND NUMBER OF CONTACTING STAGES. (EI-21005).

01265. DESALTING SALINE IRRIGATION WATER SUPPLIES FOR AGRICULTURE.

MALETIC, J.T.; SACHS, M.S.; KROUS, E.S.
NUCLEAR DESALINATION, PROC OF SYMP BY IAEA, NOV 18-22 1968, MADRID, SPAIN, IAEA, 1969 PAP SM113/37 P 207-24.

A CASE STUDY WAS PERFORMED TO EVALUATE POTENTIAL APPLICATIONS OF MULTISTAGE DISTILLATION (MSF) AND ELECTRODIALYSIS (ED) PROCESSES TO DESALTING SALINE IRRIGATION WATER FOR AGRICULTURE. THE INVESTIGATION DETERMINED THE COSTS AND BENEFITS ASSOCIATED WITH DESALTING SALINE IRRIGATION WATER AT CONCENTRATIONS OF 2600 AND 5330 MG/LITER TO CONCENTRATIONS OF 1500, 900, AND 400 MG/LITER. COSTS ARE BASED ON PROJECT FEATURES SUCH AS DESALINATION PLANTS AND STEAM GENERATING EQUIPMENT, RAW WATER COLLECTION FACILITIES, STORAGE RESERVOIRS, CONVEYANCE AND DISTRIBUTION SYSTEM. (EI-34739).

REFERENCE LIST

01266. FIFTEEN YEARS OF PROGRESS, A REVIEW OF THE UNITED STATES DESALTING PROGRAM.

EDWARDS, M.N.
NUCLEAR DESALINATION, PROC OF SYMP BY IAEA, NOV 18-22 1968, MADRID, SPAIN IAEA, 1969 PAP SM113/53 P 41-9.

STATUS OF DESALINATION TECHNOLOGY AT THE TIME THE UNITED STATES PROGRAM WAS INITIATED, AND REPORTS ON MAJOR ACTIVITIES THAT HAVE BEEN ACHIEVED. THE PRESENT STATUS OF FREEZING METHODS AND MEMBRANE PROCESSES IS DISCUSSED, BUT MAJOR EMPHASIS IS PLACED ON THE PRESENT STATE OF THE ART OF DISTILLATION TECHNIQUES AND THE UTILIZATION OF NUCLEAR REACTORS AS AN ENERGY SOURCE FOR MULTI MGD WATER ONLY OR DUAL PURPOSE POWER AND WATER PLANTS. CONTINUED ADVANCES IN DESALINATION PROCESSES' PERFORMANCE AND EFFICIENCY THAT ARE ANTICIPATED, ARE DESCRIBED TOGETHER WITH COMS IMPROVED OIL SEPARATION, PREVENTS EVAPORATION OF COLLECTED OIL, LEAVES RECOVEREMENTS ON THE EFFECT THESE ADVANCES WILL HAVE ON THE COST OF PRODUCT WATER. (EI-31913).

01267. PARALLEL PLATE INTERCEPTOR.

SHAW, E.C.; CAUGHMAN, W.L.JR.
NLGI SPOKESMAN, 33(11), 395-399, 1970.

OPERATION OF THE PARALLEL PLATE INTERCEPTOR (PPI) IN OIL RECOVERY APPLICATIONS IS DESCRIBED. IN ADDITION TO BEING REMARKABLY SIMPLE TO MAINTAIN, PPI PROVIDED OIL WITH A LOWER WATER CONTENT, AND BECAUSE OF REDUCED AIR POLLUTION AND FIRE HAZARDS, THE SEPARATOR CAN BE SITUATED CLOSER TO PROCESSING UNITS. BRIEF MENTION IS ALSO MADE OF PPI'S SUCCESSOR, THE CORRUGATED PLATE INTERCEPTOR, LOWER IN INITIAL COST AND HAVING SUPERIOR CORROSION RESISTANCE, WHILE RETAINING ALL THE OTHER ADVANTAGES OF PPI. (EI-19837).

01268. MULTISTAGE FLASH DISTILLATION DESALTING STATE OF THE ART (1968).

WONG, C.M.; STROBEL, J.J.; STURZA, H.L.
U.S. OFFICE SALINE WATER, RES DEVELOP PROGR REP 490 OCT 1969, 138 P.

THIS REPORT EVALUATES MSF PLANTS UTILIZED IN BOTH SINGLE AND DUAL PURPOSE (POWER WATER) MODES OF OPERATION OVER A POWER RANGE EXTENDING FROM 1 TO 150 MGD. THE REPORT WAS PREPARED BY REVIEWING DATA ON ACTUAL PLANTS AND CONCEPTUAL DESIGN STUDIES. A MAJOR PORTION OF THE REPORT IS CONCERNED WITH CAPITAL COST AND OPERATING COST FACETS OF THIS PROCESS. 48 REFS. (EI-25633).

01269. PILOT PLANT TESTS AND DESIGN STUDY OF A 2.5 MGD HORIZONTAL TUBE MULTIPLE EFFECT PLANT.

JELNIO, G.A.; WONG, C.M.; SEIDER, E.N.; CALLAHAN, J.T.
U S OFFICE SALINE WATER, RES DEVELOP PROGR REP 492 OCT 1969, 148 P.

A NEW CONCEPT OF MULTIPLE EFFECT DISTILLATION EQUIPMENT HAVING HORIZONTAL HEAT TRANSFER TUBES WITH STEAM CONDENSING ON THE INSIDE AND BRINE BOILING ON THE OUTSIDE AND VERTICALLY ARRANGED EFFECTS IS DESCRIBED. A 2.5 MGD PLANT HAS BEEN DESIGNED IN SUFFICIENT DETAIL TO PREPARE RELIABLE COST ESTIMATES. THE TOTAL INSTALLED CAPITAL COST OF THE WATER SECTION OF THE 2.5 MGD DUAL PURPOSE PLANT IS 63.6 CENT/GAL STREAM DAY. PRODUCT WATER COST IS 53.4 CENT/1000 GAL WITH 25 CENT/MM BTU EXTRACTION STEAM. (EI-25695).

01270. COST ANALYSIS OF SIX WATER DESALTING PROCESSES.

CLARK, C.F.; WONG, C.M.; STROBEL, J.J.; MILLER, E.F.
U.S. OFFICE SALINE WATER, RES DEVELOP PROGR REP 495 NOV 1969, 100 P.

THE CAPITAL REQUIREMENTS AND COST OF PRODUCING FRESH WATER WERE DETERMINED FOR SIX LEADING DESALINATION PROCESSES. THE MAJOR COST ELEMENTS OF EACH CONVERSION PROCESS ARE IDENTIFIED. THE EFFECTS OF VARYING IMPORTANT PROCESS PARAMETERS ON WATER COSTS ARE SHOWN FOR EACH PROCESS. THE RELIABILITY OF COST DATA IS PROBABLY HIGHEST FOR THE MULTISTAGE FLASH DISTILLATION PROCESS. SINCE THE LARGEST DESALINATION PLANTS CONSTRUCTED TO DATE HAVE BEEN OF THAT DESIGN, AND THE PROCESS HAS RECEIVED CONSIDERABLE ATTENTION FROM A RESEARCH AND ENGINEERING STANDPOINT. THE COST RELIABILITY WOULD PROBABLY BE PROGRESSIVELY SLIGHTLY LESS FOR THE VAPOR COMPRESSION, VERTICAL TUBE EVAPORATOR, ELECTRODIALYSIS, VACUUM FREEZE VAPOR COMPRESSION, AND REVERSE OSMOSIS PROCESSES. (EI-25517).

01271. SMART WATER MANAGEMENT, NOT POLLUTION CONTROL.

STICKLEY, J.D.; BLAKELEY, C.P.
INSTRUMENTATION IN THE IRON AND STEEL INDUSTRY, V 20, PROC OF 20TH INT ISA IRON AND STEEL INSTRUM SYMP, MAR 23-25, 1970, PITTSBURGH, PA. ISA, 1970, P 67-74.

POLLUTION ABATEMENT LAWS PLACE A FINANCIAL AND ADMINISTRATIVE BURDEN ON INDUSTRY. AS A RESULT INDUSTRY MUST REGARD WATER AS AN INDISPENSABLE RAW MATERIAL, APPLYING PROVEN MATERIALS MANAGEMENT TECHNIQUES TO THE MANAGEMENT THEREOF. (EI).

01272. ACTIVATED SLUDGE JOINT TREATMENT OF PULP AND PAPER EFFLUENT WITH MUNICIPAL SEWAGE.

BROSIG, A.JR; KIRK, D.G.; LISANTI, A.F.; ZABBAN, W.
TAPPI, 54(3), 386-390, 971.

A PILOT STUDY WAS MADE TO SHOW THE FEASIBILITY OF JOINT INDUSTRIAL MUNICIPAL TREATMENT OF WASTES FROM AN INTEGRATED FULLY BLEACHED SEMICHEMICAL PULP AND FINE PAPER MILL WITH ACTIVATED SLUDGE. BENCH STUDIES SHOWED THAT THERE WOULD BE LARGE ECONOMIC BENEFITS IN CONVERSION TO A FULL CHEMICAL PULPING PROCESS WITH CHEMICAL RECOVERY. THE VOLUME REQUIRING MUNICIPAL TREATMENT WOULD BE REDUCED BY 2/3. SEVERAL DESIGN PARAMETERS, INCLUDING AERATION TIME, FINAL TANK OVERFLOW RATE, AND SLUDGE HANDLING EQUIPMENT SIZES, WOULD BE REDUCED BY AS MUCH AS HALF. (EI-53022).

COST ANALYSIS OF WATER POLLUTION CONTROL

01273. BEST FEATURES OF FOUR EXISTING PLANTS HIGHLIGHTED IN NEW DETROIT WATER FACILITY.

HOWSON, L.; REMUS, G.
WATER WASTES ENG., 7(12), 50-51, 1970.

DESIGN FEATURES OF THE NEW 400 MGD PLANT UNDER CONSTRUCTION ON LAKE HURON THAT WILL COST ABOUT 70 MILLION DOLLARS. (EI-54134).

01274. COMPARISON OF METHODS OF SANITIZING WATER.

ATHERTON, H.V.
ASAE PAPER 70-759 FOR MEETING AT CHICAGO, ILL., DEC 8-11 1970, 6 P.

A SURVEY OF MODERN METHODS FOR TREATMENT OF WATER TO REMOVE UNDESIRABLE CONTAMINANTS FROM WATER IN FOOD PROCESSING PLANTS IS PRESENTED. THE EVALUATION OF METHODS IS GIVEN AMONG OTHERS FOR CHLORINATION, ULTRAVIOLET STERLIZATION AND HEAT..

01275. SOURCE CONTROL OF URBAN WATER POLLUTION.

HEANEY, J.P.; SULLIVAN, R.H.
J WATER POLLUT CONTR FED., 43(4), 571-579, 1971.

AN EXPLORATORY STUDY WAS UNDERTAKEN TO OBTAIN A SOLIDS BUDGET WITHIN AN AREA IN CHICAGO, ILLINOIS. THE SOURCES INVESTIGATED INCLUDED AIR POLLUTION, SANITARY WASTES, GARBAGE, AND MISCELLANEOUS SOLIDS. THE SOURCE CONTROLS EXAMINED WERE CATCH BASIN CLEANING, SEWER CLEANING, AND STREET SWEEPING. UNIT COSTS OF STREET SWEEPING INDICATE THAT CATCH BASINS AND THEIR CLEANING, ALONG WITH SUBSEQUENT SEWER CLEANING, MAKE THEM UNDESIRABLE. (EI-56939).

01276. DESIGN OF COOLING TOWERS CIRCULATING BRACKISH WATERS.

DEFLON, J.G.
AICHE WORKSHOP, IND PROCESS DES WATER POLLUT CONTR 2, HOUSTON, TEX, APR 24-25 1969 P 69-73.

COST AND MAINTENANCE ON COOLING TOWERS CIRCULATING BRACKISH WATER IS NATURALLY OF CONSIDERABLE CONCERN. INADEQUATE CONSIDERATION OF MATERIALS OF CONSTRUCTION AND DISREGARD OF THE SIMPLE RUDIMENTS OF WATER CONTROL CAN BE EXPENSIVE. IF THHE ABOVE SUGGESTIONS FOR DESIGNING AND OPERATING SUCH A UNIT ARE TAKEN INTO CONSIDERATION, MAINTENANCE SHOULD BE LITTLE MORE THAN THAT OF A STANDARD TOWER EMPLOYING FRESH WATER MAKEUP. (EI-56094).

01277. COOLING TOWER BLOWDOWN TREATMENT COSTS.

GLOVER, G.E.
AICHE WORKSHOP, IND PROCESS DES WATER POLLUT CONTR 2, HOUSTON, TEX APR 24-25 1969 P 74-81.

CURRENT INTEREST IN THERMAL POLLUTION WILL PROMPT THE INSTALLATION OF COOLING TOWERS AT MANY PLANTS THAT HERETOFORE HAVE NOT FOUND THEM NECESSARY. OTHER STREAM POLLUTION STANDARDS HAVE BECOME STRICTER, PARTICULARLY SO IT SEEMS WHERE BLOWDOWN CONSTITUENTS ARE CONCERNED. THESE STANDARDS WILL BE APPLIED MORE WIDELY AND MORE VIGOROUSLY IN THE NEAR FUTURE. (EI-56096).

01278. EVALUATION SHOWS DIATOMITE FILTER MOST EFFICIENT.

STEPHENS, R.W.
PUB WORKS, 101(7), 68-69, 1970.

AS RESULT OF EVALUATION OF COMPARATIVE TESTS OF BOTH DIATOMITE AND RAPID SAND FILTERS TO BE USED IN BAKERSFIELD, CALIF., 2.5 MGD FILTRATION PLANT, BASED ON EFFICIENCY AS WELL AS INITIAL AND OPERATING COSTS, THE DIATOMITE FILTER WAS JUDGED THE MOST SUITABLE. (EI-59924).

01279. OIL POLLUTION CONTROL EFFORTS, SANTA BARBARA, CALIFORNIA.

GAINES, T.H.
J PETROL TECHNOL, 22(12), 1511-1514, 1970.

THE ERUPTION OF CRUDE OIL FROM THE OCEAN FLOOR 5 1/2 MI OFFSHORE FROM SANTA BARBARA, CALIF., ON JAN 28 1969, CREATED A SUBSTANTIAL TASK OF POLLUTION CONTROL AND PROPERTY CLEANUP. DESPITE THE DIFFICULTIES ENCOUNTERED, THE BEACHES, HARBORS, HOUSES, BOATS, AND SHORELINE HAVE BEEN RESTORED TO, AND IN SOME CASES EXCEED, THEIR ORIGINAL BEAUTY AND CLEANLINESS. THE TIME CONSUMING CLEANING UP WAS COSTLY, MORE THAN 4.6 MILLION DOLLARS HAS BEEN SPENT IN PREVENTING POLLUTION AND IN RESTORING PROPERTY AND THE ENVIRONMENT. (EI-52959).

01280. WATER POLLUTION CONTROL IN PULP AND PAPER INDUSTRY.

AMBERG, H.R.
IND WATER ENG., 7(11), 26-29, 1970.

TREND IN PULP AND PAPER INDUSTRY IS REPORTED TO BE SHIFTING FROM PRIMARY TREATMENT TO REMOVE SETTLEABLE SOLIDS TO SECONDARY PROCESSES DESIGNED TO REMOVE SOLUBLE BOD. ANNUAL EXPENDITURE IN THE NEXT YEARS IS EXPECTED TO REACH 200 MILLION DOLLARS, AND WILL ADD ABOUT 3.5 DOLLARS/TON TO PRODUCT COST. LABORATORY AND PILOT PLANT STUDIES OF TREATMENT WHICH CAN BE CLASSIFIED AS TERTIARY TREATMENT ARE OUTLINED. (EI-53324).

01281. TILTED PLATE SEPARATORS FOR REFINERY WASTE WATER.

MORRISON, J.
OIL GAS J., 68(50), 86-88, 1970.

A GRAVITY TYPE SEPARATION DEVELOPED BY SHELL FOR SEPARATION OF OIL AND SLUDGE FROM REFINERY WASTE WATER STREAMS OCCUPIES ONLY ONE SIXTH OF THE FLOOR SPACE OF PLATELESS SEPARATORS AND SUBSTANTIALLY REDUCES BOTH MANUFACTURING AND MAINTENANCE COSTS. (EI-54662).

01282. TRENDS IN TREATING PETROLEUM REFINERY WASTES.

BEYCHOK, M.R.
AICHE WORKSHOP, INC PROCESS DES WATER POLLT CONTR 2, HOUSTON, TEX, APR 24-25 1969 P 54-61.

REFERENCE LIST

THE USE OF HYDROTREATING AND HYDROCRACKING HAS BEEN AND STILL IS ONE OF THE MAJOR TRENDS IN REFINING PROCESS TECHNOLOGY. THIS WILL RESULT IN MORE SULFIDIC SOUR WASTE WATERS REQUIRING FACILITIES FOR STRIPPING OUT AND RECOVERING AMMONIA AND HYDROGEN SULFIDE OR CONVERTING THEM INTO SALEABLE BYPRODUCTS. (EI).

01283. INDUSTRY DECISIONS AFFECT ECOLOGY.

KINTIGH, J.L.
FOUNDRY, 98(12), 34-37, 1970.

IT IS BECOMING EVIDENT THAT MAN CANNOT MAINTAIN AN ECOLOGICAL BALANCE WITHIN HIS OWN ENVIRONMENT WITHOUT SUBJECTING HIMSELF AND HIS AMBITIONS TO MEANINGFUL RESTRAINTS. HE WILL NOT BE ABLE TO PLAN ACTION OR OPERATIONS THAT HAVE THE POTENTIAL FOR ALTERING ANY BALANCE IN OUR ENVIRONMENT CONTINUUM. ALL CONVERSION TECHNIQUES AND PRODUCTS WILL HAVE TO WITHSTAND CRITICAL REVIEWS THAT OFTEN WILL AFFECT COSTS AND PROFITS. DECISION-MAKING WILL HAVE TO ADJUST TO THE NEW PARAMETERS. (EI-55154).

01284. HOW TO REDUCE WASTE WATER EFFLUENTS FROM PETROLEUM AND CHEMICAL PROCESS PLANTS THROUGH INITIAL DESIGN.

RABB, A.
AICHE WORKSHOP, IND PROCESS DES WATER POLLUT CONTR 2 HOUSTON, TEX, APR 24-25 1969 P 7-14.

AS TREATMENT OF THE WASTE LIQUIDS DISCHARGED FROM PROCESS INDUSTRY PLANTS GETS MORE COMPLEX AND COSTLY, THERE IS A GROWING TENDENCY TO REDUCE THE AMOUNT OF WASTE BY CAREFUL INITIAL PROCESS OR EQUIPMENT DESIGN. OFTEN THIS APPROACH WILL SHOW THAT THERE CAN BE A CONSIDERABLE INVESTMENT AND OPERATING COST SAVING IN THE EVENTUAL WASTE WATER TREATING FACILITIES BY SPENDING SOME MONEY FOR THE INITIAL ANALYSIS AND DESIGN EFFORT. (EI).

01285. FACTORY IN THE SEVENTIES.

DAWES, J.H.
PLANT ENG (LOND), 14(12), 305-321, 1970.

IN LOOKING FORWARD, THE AUTHOR CONSIDERS THE EFFECTS OF LEGISLATION, POLITICAL AND ECONOMIC FACTORS, THE CHANGING PATTERN OF INDUSTRY, POPULATION DRIFT AND DEVELOPMENT AREAS. ENVIRONMENTAL CONDITIONS AND DESIGN STANDARDS ARE DISCUSSED. POLLUTION AND EFFLUENT CONTROL ARE EMPHASIZED. (EI-56874).

01286. SALT WATER DISPOSAL--SENSE AND DOLLARS.

SMITH, W.W.
PETROL ENG., 42(11), 64, 1970.

SPECIAL REPORT ON POLLUTION REVIEWS PRESENT SITUATION.

01287. SALT WATER COOLING TOWER.

NESTER, D.M.
CHEM ENG PROGR, 67(7), 49-51, 1971.

FOR THE EXPANSION OF AN EXISTING ONCE-THROUGH SALT WATER COOLING SYSTEM, CONSTRUCTION OF A CLOSED SYSTEM SALT WATER COOLING SYSTEM WAS FOUND TO BE A COMPETITIVE ALTERNATIVE. THE INSTALLATION OF A RECIRCULATING SYSTEM AFFORDS AN OPPORTUNITY OF REMOVING THE COOLING WATER FROM THE PROCESS WATER SEWER SYSTEM AT MINIMUM COST, AND THUS OF REDUCING THE AMOUNT OF WATER REQUIRING SECONDARY TREATMENT. (EI-82068).

01288. CONOCO'S 5-MILLION DOLLAR PROGRAM TO MEET 1973 REGULATIONS.

JOHNSON, G.D.; WINEGAR, P.M.; CAYAN, W.M.
PETROCHEMICAL ENGINEERING, 1970, P 11-12, 16-18.

FOR CONTROL OF WATER POLLUTION FROM REFINERIES, CONTINENTAL OIL COMPANY PLANTS IN LOUISIANA ARE CURRENTLY CARRYING OUT PLANNED PROGRAMS COSTING A TOTAL OF 5 MILLION DOLLARS. WHEN PROJECTS IN THE CURRENT PHASE OF ITS PROGRAM ARE COMPLETED, THEY WILL MEET FUTURE STREAM CRITERIA ESTABLISHED BY THE STATE OF LOUISIANA, TO BE EFFECTIVE JANUARY 1, 1973. SEPARATE PRIMARY AND SECONDARY WASTE TREATMENT SYSTEMS HAVE BEEN DEVELOPED FOR THREE MANUFACTURING FACILITIES OPERATED AT CONOCO'S WEST LAKE, LA., COMPLEX. (EI-80074).

01289. EFFLUENT TREATMENT. CUTTING COST OF COMPLIANCE.

HAVILAND, J.M.
PROD FINISH (CINCINATI), 35(5), 46-54, 1971.

REFERENCE IS MADE TO THE PLIGHT OF 40 ELECTROPLATERS IN GRAND RAPIDS, MICH, WHO MUST COMPLY WITH STRICT REGULATIONS FOR DISCHARGE OF METALS AND OTHER CONTAMINANTS. TO MAKE POLLUTION CONTROL AS PAINLESS AS POSSIBLE, THREE WAYS THAT MIGHT HELP PLATERS RECOUP PART OR ALL OF THE COST OF WASTE TREATMENT, COULD BE USED, NAMELY, IMPROVING HOUSEKEEPING SO AS TO CONSERVE PLATING CHEMICALS, LOWERING CONSUMPTION OF WATER AND RECLAIMING MATERIALS THAT ARE NOW DISCARDED AS WASTE. (EI-82023).

01290. STATE OF THE ART REVIEW. TREATMENT AND DISPOSAL OF SWINE WASTES.

SHINDALA, A.; SCARBROUGH, J.H.
WATER SEWAGE WORKS, 118(2), 50-57, 1971.

LITERATURE SURVEYS REVEAL THAT ANAEROBIC LAGOONING OF SWINE WASTES HAS RECEIVED THE WIDEST ACCEPTANCE OF ALL THE TREATMENT PROCESSES REPORTED. IF PROPERLY LOCATED, DESIGNED, CONSTRUCTED AND MAINTAINED, ANAEROBIC LAGOONS WERE REPORTED TO PROVIDE THE MOST ECONOMICAL MEANS OF TREATING AND DISPOSAL OF SWINE WASTES. (EI-80103).

01291. HIGH PURITY WATER FOR INDUSTRIAL PROCESSES.

ABEL, H.P.
SME, WEST METAL TOOL EXPOS CONF, TECH PAP V 70 BOOK 1, MAR 9-13, 1970, PAPER MM70-706, 25 P.

THIS BRIEFLY SUMMARIZES TECHNICAL FACETS FOR ION EXCHANGE AND EQUIPMENT MODIFICATIONS TO ACHIEVE

BETTER WATER QUALITY AND DECREASE OPERATING COSTS. THE USE OF HIGH QUALITY DEIONIZED WATER IN LIEU OF DISTILLED WATER WILL ALSO GREATLY REDUCE PRODUCTION COSTS OF ANODIZING, PLATING, AND SIMILAR INDUSTRIAL APPLICATIONS. (EI-73735).

01292. VALUATION OF FLOW AUGMENTATION RELEASES.

CARTER, B.J. JR; HEANEY, J.P.; PYATT, E.E.
ASCE J SANIT ENG DIV., 97(SA3), PAPER 8203, 345-359, 1971.

A MATHEMATICAL PROGRAMMING TECHNIQUE IS USED TO DERIVE AN ESTIMATE OF THE VALUE, MEASURED IN TERMS OF WASTEWATER TREATMENT COSTS AVOIDED, OF FLOW AUGMENTATION RELEASES IN A RIVER WITH MULTIPLE WASTE SOURCES. ANALYSES ARE PERFORMED FOR A SINGLE SOURCE OF AUGMENTED FLOW IN THE HEADWATER REACHES. THE EFFECT OF THE QUALITY OF THE AUGMENTED FLOW ON ITS ECONOMIC VALUE IS QUANTIFIED. A PROCEDURE FOR INCORPORATING THE DEPENDENCE OF THE REAERATION COEFFICIENTS AND TRAVEL TIME ON THE RIVER DISCHARGE IS INCLUDED.

01293. METAL FINISHING WASTES: METHODS OF DISPOSAL.

ZIERVERS, J.F.; CRAIN, R.W.; BARCLAY, F.G.
PLATING, 57(1), 56-59, 1970.

THE METHODS OF DISPOSAL COMMONLY AVAILABLE TO THE WASTE TREATMENT SYSTEM OPERATOR POINT TOWARD THE CONSERVATION AND REUSE OF WASTE WATERS AFTER SEPARATION FROM SUSPENDED SOLIDS. THIS CAN BEST BE ACCOMPLISHED BY PRESSURE FILTRATION. IN PAST YEARS THE COST OF THIS METHOD OF DISPOSAL HAS LIMITED FILTER INSTALLATIONS. RISING WATER AND SEWAGE COSTS, HOWEVER, MAKE IT NOT ONLY DESIRABLE BUT ECONOMICALLY SOUND TO CONSIDER PRESSURE FILTRATION. (EI-74546)

01294. OPTIMIZATION OF MULTISTAGE FLASH EVAPORATION PLANTS.

MANDIL, M.A.; GHAFOUR, E.E.A.
CHEM ENG SCI., 25(4), 611-621, 1970.

A NEW APPROACH TO THE OPTIMIZATION OF MULTISTAGE FLASH EVAPORATION PLANTS IS PRESENTED. WHILE RETAINING THE BASIC FEATURES OF CURRENT THEORIES, THE APPROACH PRESENTED INVOLVES THE USE OF RELATIVE VALUES OF ECONOMIC PARAMETERS RATHER THAN THEIR ABSOLUTE VALUES. THE PAPER DEALS WITH A 3 FREE DESIGN VARIABLE PROBLEM OF CONSTANT OUTPUT WHILE TWO COST PARAMETERS MAY VARY ACCORDING TO PRESCRIBED SCHEDULES. OPTIMIZATION PROCEDURES ARE PRESENTED AND TESTED USING AN ILLUSTRATIVE EXAMPLE. (EI-62007).

01295. CONCERNING THE ECONOMIC VALUE OF EXPERIMENTATION IN THE DESIGN OF DESALTING PLANTS.

TRIBUS, M., PEZIER, J.P.
DESALINATION, 8(3), 311-349, 1970.

THE PAPER IS CONCERNED WITH THE ANALYSIS OF THE ECONOMIC WORTH OF DESIGN DATA GATHERING. DECISION ANALYSIS TECHNIQUES ARE USED IN ANALYSIS. A KELVIN FUNCTION IS SHOWN TO REPRESENT GENERALLY WELL THE BALANCE BETWEEN CAPITAL COSTS AND OPERATING COSTS FOR DESALTING PLANTS. (EI-67780).

01296. DIMENSIONS OF WATER MANAGEMENT.

DROBNY, L.
PROCEEDINGS OF THE FIRST ANNUAL OHIO WATER RESOURCES CONFERENCE, SPONSORED BY THE OHIO SECTION, AMERICAN WATER RESOURCES ASSOCIATION IN COOPERATION WITH THE OHIO DEPARTMENT OF NATURAL RESOURCES, MAR 24 1970, COLUMBUS, OHIO.

COVERING THE POLITICAL AND LEGAL DIMENSIONS, THE SYSTEMS ANALYSIS AND ENGINEERING DIMENSIONS, THE ENVIRONMENTAL/ECOLOGICAL DIMENSION, AND THE SOCIOECONOMIC AND PUBLIC DIMENSIONS OF WATER MANAGEMENT. OTHER TOPICS DISCUSSED WERE LOCAL PROGRESS IN OHIO WATER MANAGEMENT; STATE WATER PLANNING, REGIONAL APPROACHES TO WATER MANAGEMENT; THE INDUSTRIAL PERSPECTIVE ON WATER MANAGEMENT, AND FEDERAL PARTICIPATION IN OHIO WATER MANAGEMENT. CONFERENCE SUMMARY IS INCLUDED. (EI-67840).

01297. WATER QUALITY FACTORS ON THE COST AND PERFORMANCE OF COOLANTS.

HUMNICKY, S.
SME, COLLECT PAP V 70 BOOK 3 APR 13-17 1970 PAPER MR70-253, 14 P.

THIS DISCUSSION IS CONCERNED MAINLY WITH RAW WATER QUALITY WHERE THIS QUALITY AFFECTS WATER SOLUBLE CUTTING AND GRINDING PERFORMANCE. IT INCLUDES SOME BASIC INFORMATION ON THE FACTORS AFFECTING RAW WATER QUALITY METHODS OF SOLVING THIS PROBLEM AND A CASE HISTORY OF ONE PREFERRED METHOD OF SOLVING THIS PROBLEM. (EI.

01298. ECONOMIC DESIGN OF CENTRAL WATER SUPPLY SYSTEMS FOR MEDIUM-SIZED TOWNS.

SINGH, K.P.
WATER RESOURCE BULLETIN 7(1), 79-92, 1971.

SEVEN COST ELEMENTS ARE SHOWN TO BE PERTINENT TO THE OPTIMUM OR LEAST COST DESIGN OF NETWORK CONSISTING OF PIPE LINES AND PUMPING STATIONS. WATER CONVEYANCE COSTS ARE CALCULATED FOR VARIOUS FLOW RATES, PIPE LINE DIAMATERS, FLOW VARIABILITIES, STATIC HEADS, AND INTEREST RATES, THUS PROVIDING A MEASURE OF SENSITIVITY OF THE CONVEYANCE COST TO SUCH VARIATIONS. THE ECONOMIES OF SCALE, THE SENSITIVITY OF OPTIMUM UNIT CONVEYANCE COSTS, AND VARIATIONS IN UNIT COSTS WITH CHANGE IN COST FUNCTIONS USEFUL IN MAKING A FEASIBILITY STUDY FOR PROPOSED CONVEYANCE SYSTEM. (EI-65733).

01299. FILTRATION OF COOLANTS PAYS DIVIDENDS.

WILLIAMS, N.
SME, COLLECT PAP V 70 BOOK 3 APR 13-17 1970 PAPER MR70-254, 9 P.

METHODS OF FILTRATION ARE GIVEN AND DISCUSSED. THESE INCLUDE SETTLING AND SEDIMENTATION, FLOTATION, MAGNETIC SEPARATORS, FLOTATION, CENTRIFUGAL CLARIFIERS, HYDRO OR LIQUID CYCLONES, GRAVITY FLOW FILTRATION, POSITIVE FILTRATION, SUCTION OR PRESSURIZED FLOW, AND PRESSURE BACK FLUSHING. (EI-63497)

REFERENCE LIST

01300. SEWER DESIGN AND COST ESTIMATION BY COMPUTER.

ZEPP, P.
PUBLIC WORKS, 101, 1970, 90-91.

COMPUTER PROGRAM FOR REGIONAL PLANNING SEWER MODEL IS DESCRIBED. THE INPUTS TO THE MODEL INCLUDE THE PHYSICAL LAYOUT OF A SEWER SYSTEM, THE DEMAND UPON THIS SYSTEM IMPLIED BY ANTICIPATED LAND USE, AND CERTAIN ENGINEERING DESIGN CONSTRAINTS. PIPES WHERE PUMPING STATIONS AND FORCE MAINS ARE TO BE CONSIDERED ARE SPECIFIED. (EI-65766).

01301. INSTALLATION FOR THE COMBUSTION OF INDUSTRIAL WASTE.

VOEGE, T.; SCHLOTMANN, W.
BRENNS WAERME KRAFT, 22(10), 461-464, 1970.

AFTER DISCUSSION OF REASONS FOR BUILDING THE PLANT AND THE TYPE OF INSTALLATION, A DETAILED DESCRIPTION OF ITS TECHNICAL EQUIPMENT AND FEATURES IS GIVEN. OPERATIONAL EXPERIENCE AND RESULTS OF MEASUREMENTS ARE DISCUSSED AND INFORMATION GIVEN ON THE INVESTMENT INVOLVED AND THE COST OF OPERATION. IN GERMAN WITH ENGLISH ABSTRACT. (EI-65200).

01302. FINAL DISPOSAL OF RADIOACTIVE WASTES.

RAMDOHR, H.
KERNTECHNIK, 12(5-6), 242-248, 1970.

AFTER A SURVEY OF THE METHODS AVAILABLE AND THE SITUATION IN WEST GERMANY, SOLIDIFICATION AND FINAL DISPOSAL OF RADIOACTIVE WASTES IN ROCK SALT FORMATIONS OF DEEP GEOLOGICAL STRATA SEEM TO BE THE BEST PRACTICE. HIGH ACTIVITY WASTES ARE IN GENERAL, MELTED INTO GLASS OR CERAMICS. THEIR FINAL DISPOSAL IS CARRIED OUT IN A SALT MINE IN NORTHERN GERMANY. THE COSTS OF SOLIDIFICATION AND FINAL DISPOSAL ARE ESTIMATED TO BE ABOUT 1% OF THE GENERATING COST OF NUCLEAR ENERGY. 34 REFS. IN GERMAN AND ENGLISH. (EI-61658).

01303. ALUM RECOVERY FOR FILTRATION PLANT WASTE TREATMENT.

FULTON, G.P.
WATER WASTES ENG., 7(6), 48-81, 1970.

THE RECOVERY OF ALUM AS A WASTE TREATMENT METHOD IS DESCRIBED. BENEFITS OF THE ALUM RECOVERY APPLICATION ARE DISCUSSED. IT IS SHOWN THAT THE SOLIDS REQUIRING DISPOSAL ARE SIGNIFICANTLY REDUCED. WITH PROPER PROCESS CONTROL OF THE ALUM PRODUCT FLOW, UNWANTED SOLIDS CAN BE EASILY SEPARATED AND THICKENED FOR ULTIMATE DISPOSAL. WASTE TREATMENT COSTS ARE DEFRAYED, TO SOME EXTENT, BY REDUCING THE NEED FOR NEW MAKE-UP ALUM, AND COST OF ALUM PURCHASED FOR WATER TREATMENT AND MATERIALS HANDLING ARE REDUCED. (EI-66053).

01304. VACUUM FREEZING VAPOR COMPRESSION PROCESS.

CONSIE, R.; DARLING, R.; EMMERMANN, D.; FRASER, J.; JOHNSON, W.; KORETECHKO, J.; TORVBRATEN, F.; HUNTER, J.A.; RINNE, W.W.; GRANSEE, C.L.
U. S. OFFICE SALINE WATER, RES DEVELOP PROGR REP 451 MAY 1969, 67 P.

STUDY ON 1 AND 5 MGD DESALTING PLANTS USING THE VFVC VACUUM FREEZING VAPOR COMPRESSION PROCESS. THESE PLANTS UTILIZE 1/2 MGD FACTOR ASSEMBLED MODULES IN GROUPINGS OF 2 AND 10 TO FORM THE DESALTING PLANTS. COSTS, BASED ON LOCATING THE PLANT WRIGHTSVILLE BEACH, NC, YIELD PRODUCT WATER COSTS OF 61.5 AND 51.3 CENTS/K GAL., FOR PLANTS OF 1 AND 5 MGD, RESPECTIVELY. INSTALLED COSTS OF THE PLANTS ARE 1 DOLLAR AND 25 CENTS AND 1 DOLLAR AND 10 CENTS/GAL OF DAILY CAPACTIY. THE PLANTS ARE EXTREMELY EFFICIENT CONSUMING 27.3 KW/K GAL OF ELECTRICITY. FULL AUTOMATIC OPERATION OF THE PLANTS REDUCES THE LABOR COSTS TO A MINIMUM. AN ALTERNATE CONFIGURATION UTILIZING A GAS TURBINE AND HEAT RECOVERY BOILER FURTHER REDUCES COSTS OF 41.9 CENTS/K GAL FOR THE 5 MGD PLANT. (EI-08444).

01305. COST EFFECTIVENESS STUDY OF PRETREATMENT METHODS FOR MEMBRANE DESALTING PLANTS.

KNEALE, J.S.; KELLEY, E.M.; HUNTER, J.A.; SAVAGE, W.F.; CHANNABASAPPA, K.C.
U.S. OFFICE SALINE WATER, RES DEVELOP PROGR REP 425 MAY 1969, 90 P, APPENDICES.

AN ENGINEERING STUDY HAS BEEN MADE TO DETERMINE THE COST EFFECTIVENESS OF PRETREATMENT SYSTEMS FOR MEMBRANE DESALTING PROCESSES. THIS REPORT DETAILS THE EQUIPMENT AND CHEMICALS REQUIRED, WASTE PRODUCTS PRODUCED, CHEMICAL OPERATING COSTS, TOTAL OPERATING COSTS AND INSTALLED PLANT EQUIPMENT COSTS. (EI-07815)

01306. MARGINAL VALUES OF DILUTION WATERS.

MERRITT, L.B.
WATER RESOURCES RESEARCH, 5(6), 1186-1195, 1969.

THE MARGINAL VALUE OF WATER FOR DILUTION OF WASTE IS SMALL WHEN COMPUTED ON EITHER A LONG RUN OR A SHORT RUN BASIS. A POLICY OF CLEAN WATER PLACES A LOW MARGINAL VALUE ON DILUTION WATER SINCE THESE VALUES INCREASE IN MANY SITUATIONS WITH ANY INCREASE IN ALLOWABLE CONCENTRATION OF WASTE IN THE RECEIVING WATER. THE MARGINAL VALUE OF WATERS USED TO DILUTE SALINE IRRIGATION RETURN FLOWS IS GENERALLY HIGHER THAN THOSE USED TO DILUTE OXYGEN DEMANDING WASTES BECAUSE OF THE RELATIVE CURRENTLY HIGHER SALT REMOVAL TREATMENT COSTS AND THE MUCH HIGHER ALLOWABLE RECEIVING WATER CONCENTRATION FOR MOST SALTS. (EI).

01307. HOW ECONOMICAL AND SAFE ARE OUR SEWER INSTALLATIONS.

ZOELLNER, G.E.
U.S. OFFICE SALINE WATER, RES DEVELOP PROG RPT. 406 (1969), 132 P.

REPORT CONTAINS THE RESULTS OF THE SECOND HALF OF A 27 MO STUDY OF THE CHEMISTRY OF MIXED IONIC EXTRACTANT SYSTEMS AND THEIR POSSIBLE APPLICATION TO THE RECOVERY OF BYPRODUCTS FROM DESALINATION AND OTHER BRINES. PRELIMINARY ECONOMIC ESTIMATES ARE GIVEN FOR THE EXTRACTION AND RECOVERY OF MAGNESIUM CHLORIDE AS THE SOLID 6 HYDRATE FROM 3X AND 10X SEAWATER, AND BITTERN. (EI-08375).

COST ANALYSIS OF WATER POLLUTION CONTROL

01308. RECOVERY OF SALTS FROM SALINE WATER VIA SOLVENT EXTRACTION.

RINSTEAD, R.R.; DAVIS, J.C.; SNIDER, S.W.; HUNTER, J.A.; GILLAM, W.S.; LEISSERSON, L.
WATER POLLUT CONTR., 108(7), 24-26, 28, 1970.

THE MARSTON STRUCTURAL SEWER DESIGN METHOD IS USED FOR DETERMINING THE VERTICAL LOAD ON BURIED CONDUITS. THE METHOD MAKES CLASSIFICATIONS OF TRENCH, EMBANKMENT, AND TUNNEL CONDITIONS. THE TRENCH AND EMBANKMENT CONDITIONS ARE DISCUSSED. CALCULATION OF SUPPORTING STRENGTH OF PIPES, STRUCTURAL SEWER DESIGN CHARTS TO FACILITATE AND TO IMPROVE THE DESIGN, SUPERVISION AND INSTALLATION OF SEWERS ARE PRESENTED. (EI-09469).

01309. STUDY OF 250 MGD MULTISTAGE FLASH DISTILLATION PLANT WITH TWO LEVEL BRINE FLOW.

HAMMOND, R.P.; HUNTER, J.A.; SIEDER, E.N.; TOMALIN, P.G.
U S OFFICE SALINE WATER, RES DEVELOP PROGR REP 389 MAR 1969, 254 P.

THE SCOPE OF THIS EFFORT INCLUDED THE DEVELOPMENT OF COST AND DESCRIPTIVE INFORMATION FOR A 250 MGD EVAPORATOR OF POTENTIAL USE IN 1975 TO 1980. DEVELOPMENT OF DESIGN CRITERIA BASED ON GROUND RULES AND ON THE ASSUMPTION THAT THE PLANT WOULD BE LOCATED IN SOUTHERN CALIFORNIA. COST ESTIMATES, INCLUDING CAPITAL, OPERATING, AND MAINTENANCE COSTS AS WELL AS UNIT WATER COSTS ARE GIVEN. DESCRIPTION OF PLANT DESIGN CONCEPTS AND DEVELOPMENT OF CONCEPTUAL DESIGN AND DETAIL DRAWINGS ARE INCLUDED.

01310. SHELL'S SWD MEETS POLLUTION STANDARDS.

BLEAKLEY, W.B.
OIL GAS J., 68(38), 144-146, 1970.

ALL PRODUCED SALT WATER IN SHELL OIL CO'S ONSHORE DIVISION, SOUTHERN REGION, IS INJECTED INTO SUB SURFACE BRINE CONTAINING FORMATIONS OR DUMPED INTO SURFACE WATERS INFLUENCED BY GULF OF MEXICO TIDES. SHELL'S OBJECTIVE WAS ACCOMPLISHED TO ELIMINATE ANY CHANCE OF POLLUTION OF FRESHWATERS OR ARABLE LANDS, AT A COST OF 6 MILLION DOLLARS. FLOWSHEET OF PROCESS IS SHOWN. (EI-02135).

01311. GULF CUTS COST OF DRILLING DEEP TEXAS PANHANDLE WELLS.

BERRY, S.C.
OIL GAS J., 68(22), 80-81, 84-86, 1970.

IN THE PAST 2 YRS, THE COST OF 20,000 FT WELLS IN THE TEXAS PANHANDLE HAS BEEN CUT FROM OVER 2 MILLION DOLLARS TO 1.258 MILLION DOLLARS FOR A RECENT WELL. HAVING A WORKABLE DRILLING PLAN, TAKING SOME RISKS TO TRY NEW METHODS, AND EXCELLENT SUPERVISION HAS HELPED GULF ACHIEVE THIS REDUCTION. (EI-01581).

01312. OPTIMIZATION OF AN ELECTRODIALYSIS PLANT.

BELFORT, G.
DESALINATION, 8(2), 153-166, 1970.

USING MODELS OF BOTH THE COST PROCEDURES AND THE PHYSICAL PLANT DESIGN, AN OPTIMIZATION ROUTINE IS CONSTRUCTED FOR AN ELECTRODIALYSIS PLANT. ITERATIVE TECHNIQUES ARE USED. THE ALGORITHM IS APPLIED TO THE OFFICE OF SALINE WATER TEST BED PLANT AT WEBSTER, SOUTH DAKOTA AND COMPARES THE ACTUAL COST AND OPERATING CONDITIONS WITH OPTIMAL AND NONOPTIMAL CONDITIONS. USES OF OPTIMIZATION ARE ALSO DISCUSSED. (EI-39097).

01313. CONTINUOUS DEMINERALIZATION PAYS DIVIDENDS.

PAULS, S.; SETH, S.
POWER, 114(11), 77, 1970.

A 1000 GPM, TWO BED CONTINUOUS COUNTERCURRENT DEMINERALIZING SYSTEM CONSISTING OF TWO 500 GPM UNITS IS DEPENDABLE AND SAVES CONSIDERABLE MONEY AND SPACE AT THE SAME TIME. (EI-40893).

01314. MATHEMATICAL MODEL FOR WATER-WASTEWATER SYSTEMS.

WEDDLE, C.L.; MUKHERJEE, S.K.; PORTER, J.W.; SKARHEIM, H.P.
J AMER WATER WORKS ASS., 62(12), 769-775, 1970.

THE AUTHORS PRESENT A NETWORK ANALYSIS BASED MODEL FOR SELECTING THE LEAST COST WATER SUPPLY AND WASTEWATER DISPOSAL SYSTEM FOR A MUNICIPAL AREA AND FOR DETERMINING THE MOST ECONOMICAL USAGE OF WATER SOURCES, INCLUDING CONVENTIONAL SOURCES, DESALTED SEAWATER, AND RENOVATED WASTEWATER. IT IS REPORTED THAT ALL ALTERNATIVES CAN BE SIMULTANEOUSLY ANALYZED WITHIN THE CONTEXT OF AN INTEGRATED WATER AND WASTEWATER TREATMENT, STORAGE, AND CONVEYANCE SYSTEM. (EI-39903).

01315. SIMULATION/OPTIMIZATION TECHNIQUES FOR MULTI-BASIN WATER RESOURCE PLANNING.

EVENSON, D.E.; MOSELEY, J.C.
WATER RESOURCE BULLETIN 6(5), 725-736, 1970.

A SET OF OPTIMIZATION AND SIMULATION TECHNIQUES CAPABLE OF ANALYZING IN DETAIL A LARGE WATER RESOURCE SYSTEM IS EXPLAINED. A SIMULATION PROCEDURE, EMPLOYING A DIRECT SOLUTION OF A SET OF LINEAR EQUATIONS, AND AN OPTIMIZATION PROGRAM ARE USED TO DESCRIBE THE HYDRAULIC BEHAVIOR AND COMPUTE THE INCURRED COSTS. A NETWORK FLOW CODE, THE OUT OF KILTER ALGORITHM IS USED IN AN OPTIMIZATION MODEL TO DETERMINE THE BEST RESERVOIR OPERATING RULES AND THE LEAST COST FLOW ROUTING. (EI-43556).

01316. ALLOCATING WATER AMONG ALTERNATIVE USES.

REYNOLDS, J.E.
ASCE J IRRIG DRAIN DIV., 97(IR1), PAPER 7978, 85-92, 1971.

ECONOMIC CRITERIA FOR DETERMINING THE ALLOCATION OF WATER AMONG COMPETING USES AND USERS ARE DEVELOPED. THE EFFECT OF PHYSICAL AND INSTITUTIONAL FACTORS ON ALLOCATION DECISIONS IS ANALYZED. DIFFICULT PROBLEMS OF ESTIMATION INVOLVED IN THE APPLICATION OF ECONOMIC CRITERIA TO WATER ALLOCATION SITUATIONS ARE DISCUSSED. (EI-42814).

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01317. A NEW DEVICE FOR WASTEWATER TREATMENT SLUDGE CONCENTRATION.

GOODMAN, B.L.
WATER WASTES ENG., 7(8), 30-32, 1970.

A NEW WASTEWATER TREATMENT SLUDGE CONCENTRATOR IS DESCRIBED THAT UTILIZES A COMBINATION OF SLUDGE CONDITIONING, GRAVITY DEWATERING, AND PRESSURE DEWATERING TO GREATLY INCREASE THE SOLIDS CONTENT OF WASTE SLUDGES PRIOR TO THEIR FINAL DISPOSAL. FOLLOWING THE DEVELOPMENT OF THIS CONCENTRATOR, SEVERAL FIELD TRIALS WERE CONDUCTED THE RESULTS OF WHICH WERE THE EFFICIENT AND ECONOMIC DEWATERING OF PRIMARY, SECONDARY, DIGESTED, AND COMBINED SLUDGES. (EI-41006).

01318. DESIGN, CONSTRUCTION AND MAINTENANCE OF WASTE STABILIZATION LAGOONS.

STOLTENBERG, D.H.
PUB WORKS, 101(9), 103-106, 1970.

LIQUID DEPTH AND SURFACE AREA AS MAJOR FACTORS AFFECTING THE DESIGN OF LAGOONS ARE DISCUSSED. CONSTRUCTION DETAILS FOR A LAGOON, DATA ON CONSTRUCTION COSTS FOR FEDERAL HOUSING ADMINISTRATION FINANCED LAGOONS IN ILLINOIS, OPERATION AND MAINTENANCE COSTS, ARE INCLUDED. (EI-43117).

01319. ECONOMICS OF LARGE SCALE REVERSE OSMOSIS PLANTS.

CHANNASAPPA, K.C.; HARRIS, F.L.
IND WATER ENG., 7(10), 20-24, 1970.

A DETAILED ENGINEERING AND ECONOMIC EVALUATION OF REVERSE OSMOSIS TO DETERMINE THE SCALE UP POTENTIAL IN LARGE BRACKISH WATER DESALTING PLANTS AND TO ESTIMATE BOTH THE CAPITAL AND OPERATING COSTS OF THESE PLANTS IS GIVEN.

01320. CONTROL OF WATER QUALITY IN A COMPLEX NATURAL SYSTEM.

DYSART, B.C. III; HINES, W.W.
IEEE TRANS SYST SCI CYBERN., 6(4), 322-329, 1970.

AN APPROACH TO WATER QUALITY CONTROL IS PRESENTED FOR THE CASE WHERE THERE COULD BE SIGNIFICANT INTERACTION OF WASTES IN A STREAM. A FREE FLOWING STREAM WHICH RECEIVES THERMAL AND ORGANIC WASTES IS MODELED AS AN N STAGE SERIAL SYSTEM. TWO DIMENSIONAL DYNAMIC PROGRAMMING IS USED TO DETERMINE MINIMUM COST CONTROL POLICIES. THE RESPONSE OF TOTAL SYSTEM COST AND CONTROL POLICY TO VARIATION OF QUALITY STANDARDS IS PRESENTED. (EI-52002).

01321. PIPELINES FOR SEWAGE DISPOSAL. PRACTICAL SOLUTION.

WASP, E.J.
COMPOST SCI., 11(5), 16-17, 1970.

AN 18 MO STUDY WAS COMPLETED IN SEPTEMBER 1969 FOR THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION BY BECHTEL CORPORATION TO DETERMINE THE TECHNICAL FEASIBILITY, COSTS AND EFFECTIVENESS OF TRANSPORTING SEWAGE TREATMENT PLANT SLUDGE AND DREDGING SPOILS BY PIPING. SPECIFIC SYSTEMS INVESTIGATED INCLUDED LAND DISPOSAL SYSTEM FOR THE NORTHEAST OHIO REGION, AND AN OCEAN DISPOSAL SYSTEM FOR THE BALTIMORE WASHINGTON REGION. (EI-46813).

01322. SIGNIFICANCE OF A SYSTEMS ANALYSIS OR BENEFIT COST APPROACH IN DEVELOPING OCEAN POTENTIAL.

JOHNSON, M.G.
CRITICAL LOOK AT MARINE TECHNOLOGY, 4TH ANNU CONF AND EXHIB, MAR TECHNOL SOC, JULY 8-10 1968, WASHINGTON. D.C., 1968 P 1-8.

A BROAD OVERVIEW IS PRESENTED OF THE DIFFICULTIES IN FORMULATING OBJECTIVES, DEVELOPING ALTERNATIVES FOR MANAGING THEM, ALONG WITH CONCEPTS OF BENEFITS AND COSTS FOR ASSISTING DECISION MAKERS. (EI).

01323. ABATEMENT PROCEDURE RELATED TO ACID MINE DRAINAGE.

WAYMAN, C.H.
AICHE WORKSHOP, INC PROCESS DES WATER POLLUT CONTR V 2, HOUSTON, TEX, APR 24-25 1969 P 38-44.

AN ATTEMPT HAS BEEN MADE TO SET FORTH THE CRITERIA KNOWN TO DATE TO ACCOUNT FOR THE PRODUCTION OF ACID MINE DRAINAGE FROM OXIDATION OF MINERAL SULFIDES. (EI-51349).

01324. ECONOMIC ASPECT OF WATER SOFTENING BY PASSAGE ON CATIONIC RESINS. INTEREST OF AUTOMATIC CONTROL OF END OF CYCLE.

GUIGUES, F.; OBERT, J.C.
REV GEN TERM., 9(98), 157-162, (IN FRENCH), 1970.

01325. SYSTEM COSTS SAY OPTIMIZE COOLING.

NICOLI, L.G.; JASKE, R.T.; WITT, P.A.
HYDROCARBON PROCESS, 49(10) SEC 1, P 97-100, 1970.

THE INCREASING COST OF HEAT REJECTION IS AGGRAVATED BY TOUGHER COMPETITION FOR AIR AND WATER USE AND MORE RIGID CONTROLS. IMAGINATIVE DESIGN IS REQUIRED TO CURB THESE COSTS. NEW TECHNOLOGY AND THE COMPUTER CAN OPTIMIZE PLANT SYSTEMS. (EI-37834).

01326. DESTRUCTION OF ORGANIC SUBSTANCES IN WASTEWATER BY IONIZING RADIATION.

COMPTON, D.J.
CHEM ENG PROGR SYMP SER., 66(104), 195-104, 1970.

THE OBJECT OF THIS WORK IS TO OBTAIN SOME RELIABLE DATA ON THE OXIDATION AND REMOVAL OF ORGANIC IMPURITIES IN WASTEWATERS, USING IONIZING RADIATION, WITH PARTICULAR ATTENTION TO THE USE OF REAL WASTEWATERS AND NOT SYNTHETIC MIXTURES, TOO THE USE OF CAREFUL CONTROL MEASUREMENTS SINCE WASTEWATERS ARE LIVE AND CHANGE RAPIDLY WITH TIME; TO THE FORMULATION OF A THEORETICAL MODEL; AND TO EXPRESSING THE RESULTS IN ENGINEERING UNITS SUSCEPTIBLE TO ECONOMIC ANALYSIS. (EI-35181).

COST ANALYSIS OF WATER POLLUTION CONTROL

01327. TECHNOLOGY NEEDED FOR THE ECONOMIC USE OF DESALTED WATER IN AGRICULTURE.

ANDERSON, T.D.
NUCLEAR DESALINATION, PROC OF SYMP BY IAEA, NOV 18-22 1968, MADRID, SPAIN, IAEA, 1969 PAP SM113/27 P 785-96.

THIS PAPER SUMMARIZES THE PRESENT ECONOMIC POSITION OF DESALTING IN AGRICULTURE AND DISCUSSES THE IMPROVED TECHNOLOGY OF NUCLEAR REACTORS, DESALINATION PLANTS AND OF CROP PRODUCTION WHICH IS NEEDED AND THE EXTENT TO WHICH IT APPEARS TO BE FORTHCOMING. FOR REACTORS, TWO IMPORTANT FACTORS WILL AFFECT ENERGY COSTS IN THE FUTURE--THE ADVENT OF VERY LARGE UNITS AND THE ARRIVAL OF THE ADVANCED BREEDERS. THE ECONOMIC CONSEQUENCES AND THE PROBABLE TIMING OF EACH OF THESE IS DISCUSSED. FOR SEAWATER EVAPORATION EQUIPMENT, THE IMPORTANCE OF ENHANCED HEAT TRANSFER SURFACE AND LARGE PLANTS ON ECONOMICS IS EMPHASIZED, AND RECENT DEVELOPMENTS IN THIS DIRECTION ARE SUMMARIZED. (EI-38293).

01328. WATER POLLUTION CONTROL. 5 BILLION DOLLAR TAB.

LAVERTY, C.
RUBBER WORLD, 160(1), 48-49, 1969.

SUMMARY OF VARIOUS USES OF RUBBER FOR COMBATING WATER POLLUTION; CHUNKS OR STRIPS OF RUBBER COMPOUNDS CONTAINING RELATIVELY INSOLUBLE ORGANO METALLIC COMPOUNDS OR ALKANOLAMINE SALTS OF SALICYLANILIDES AS TOXICANTS ARE DROPPED INTO CONTAMINATED WATER FOR BIOCIDAL ACTION LASTING 1 YR OR MORE; OTHER ANTIPOLLUTION METHODS EMPLOY GIANT (100,000 GAL) RUBBERIZED PILLOW TANKS TO BE USED AS TEMPORARY STORAGE FOR SEWAGE OVERFLOW TRIGGERED BY HEAVY RAINS, NYLON REINFORCED POLYCHLOROPRENE FABRIDAM RUBBER GATES FOR STORM CONTROL, AND ACID RESISTANT HOSE FOR CARRYING PICKLE LIQUOR TO STORAGE TANKS FOR TREATMENT AND UTIMATE DISPOSAL IN UNDERGROUND SANDSTONE RESERVOIR. (EI-35260).

01329. PHYSICOCHEMICAL TREATMENT OF WASTEWATER.

WEBER, W.J.JR; HOPKINS, C.B.; BLOOM, R. JR.
WATER POLLUTION CONTROL FEDERATION J., 42(1), 83-99, 1970.

A PROCESS EMPLOYING CHEMICAL CLARIFICATION, FILTRATION, AND ADSORPTION BY ACTIVATED CARBON WAS DEVELOPED AND RESEARCHED ON PILOT SCALE FOR THE TREATMENT OF PRIMARY WASTES. THIS PHYSICOCHEMICAL PROCESS IS A MAJOR DIVERGENCE FROM THE CONCEPT OF THE MORE EXPENSIVE TERTIARY TREATMENT FOLLOWING SECONDARY PROCESSES. THE RESEARCH REVEALED TOTAL ORGANIC CARBON AND BOD REMOVALS OF 95 TO 97%, 90% PHOSPHATE REMOVAL, AND 95% NITRATE REMOVAL. COSTS ARE ABOUT 16 CENTS/1000 GAL, INCLUDING AMORTIZATION OF THE CAPITAL. (EI-30535).

01330. MINE WATER RESEARCH. CATALYTIC OXIDATION OF FERROUS IRON IN ACID MINE WATER BY ACTIVATED CARBON.

MIHOK, E.A.
U S BUR MINES- REPORT INVESTIGATIONS 7337 DEC 1969, 7 P.

MINE WATER RESEARCH SHOWS THAT FERROUS IRON IS RAPIDLY OXIDIZED. THIS INDICATES THAT AIR OXIDATION OF FERRUGINOUS ACID IN MINE WATERS IS CATALYZED BY ACTIVATED CARBON. THE FERROUS IRON CONTENT OF AN ACID MINE WATER FLOWING THROUGH AN ASPIRATED ACTIVATED CARBON COLUMN WAS REDUCED FROM ABOUT 700 TO ABOUT 40 PPM IN LESS THAN 1 MIN. INCORPORATING A CATALYTIC OXIDATION STEPIN THE TREATMENT OF ACID MINE WATERS CONTAINING FERROUS IRON WOULD GREATLY FACILITATE NEUTRALIZATION-PRECISE CONTROL OF PH, LOWER REAGENT COSTS, ELIMINATION OF AERATION EQUIPMENT, AND SMALLER HOLDING PONDS. (EI-24191).

01331. INTEGRATED MONITORING SYSTEM FOR WATER QUALITY MANAGEMENT IN OHIO VALLEY.

KLEIN, W.L.; DUNSMORE, D.A.; HORTON, R.K.
ILLINOIS, UNIV COLLEGE OF ENG- SANITARY ENG CONFERENCE, 11TH-PROC FEB 5-6 1969 P 106-17.

ORSANCO ROBOT MONITOR SYSTEM CONSISTS OF 14 FIELD STATIONS, CENTRAL RECEIVING STATION AND DATA PROCESSING CENTER. INFORMATION ON WATER QUALITY IS TELEMETERED AUTOMATICALLY FROM THE FIELD STATIONS EACH HOUR. WATER QUALITY CHARACTERISTICS MEASURED INCLUDE PH, OXIDATION REDUCTION POTENTIAL, CHLORIDES, DISSOLVED OXYGEN, TEMPERATURE, CONDUCTIVITY AND SOLAR RADIATION. UTILIZING THE SYSTEM DEVELOPED FOR THE OHIO VALLEY, IT HAS BEEN POSSIBLE TO PROVIDE A MORE ACCURATE APPRAISAL OF DAILY RIVER CONDITIONS, TO TRACE SPILLS AND ACCIDENTAL DISCHARGES FOR THE PROTECTION OF DOWNSTREAM WATER USERS, AND TO FORECAST CHANGES IN QUALITY. THE DATA WOULD ALSO PERMIT THE EVALUATION OF DIFFERENT LEVELS OF WASTE TREATMENT, UNDER CHANGING FLOW PATTERNS, USING REAL DATA. THE EXPERIENCE GAINED AND COSTS INCURRED IN USING THE PRESENT SYSTEM FORM A BASIS FOR PROJECTING REQUIREMENTS FOR FUTURE NEEDS. (EI-23257).

01332. ECONOMICS OF ELECTROPLATING WASTES DISPOSAL.

BARNES, G.E.
PLATING, 55(7), 727-731, 1960.

SANITARY SIGNIFICANCE OF WASTES FROM ELECTROPLATING, RECAPITULATION OF TREATMENT METHODS AND WHAT THEY ACCOMPLISH, CHEMICAL EQUATIONS TO BE USED IN DETERMINING COST OF CHEMICALS APPLIED FOR PARTIAL AND TOTAL DESTRUCTION OF TOXICITY ARE REPRESENTED, MECHANICS OF CONTROLLED RINSING AS A REQUISITE FOR WASTES RECOVERY, ECONOMIC ANALYSIS OF ALTERNATIVES, AND EXAMPLES FROM PRACTICE ARE GIVEN. BEFORE AES, SAN FRANCISCO, CALIF, JULY 1968

01333. ELECTROLYTIC DECOMPOSITION OF CONCENTRATED CYANIDE PLATING WASTES.

EASTON, J.K.
WATER POLLUTION CONTROL FEDERATION J., 69(10, 1621-1625, 1967.

TOXICITY OF CONCENTRATED CYANIDE PLATING WASTES CAN BE REDUCED BY ELECTROLYZING AT 200 F USING ANODE CURRENT DENSITY OF 35 AMP/SQ FT AND CATHODE CURRENT DENSITY OF 70 AMP/SQ FT; HEAT AND ELECTROLYTIC ACTION BREAK CYANIDE DOWN INTO AMMONIA, CARBON DIOXIDE, AND NITROGEN, AND BREAKDOWN PRODUCTS CAN BE EXHAUSTED SAFELY TO ATMOSPHERE; TOXIC METALLIC CONTAMINANTS ALSO ARE

REMOVED; ADVANTAGES OF PROCESS INCLUDE USE OF SIMPLE EQUIPMENT AND OPERATING PROCEDURES ALREADY FAMILAR TO ELECTROPLATERS, AND LOW COST; COSTS FOR REDUCING CYANIDE CONCENTRATION WERE APPROXIMATELY 4 CENTS/LB CYANIDE DECOMPOSED. (EI).

01334. PAPER MILL SLUDGE DEWATERING.

KOENITZER, G.H.
TAPPI, 51(12), 53-56, 1968.

THREE TYPES OF EQUIPMENT GENERALLY CONSIDERED FOR DEWATERING OF PAPER MILL SLUDGE-VACUUM FILTER, CENTRIFUGE, AND PRESS; VACUUM FILTER HAS GREATER SOLIDS RECOVERY; DISADVANTAGES ARE COST OF INSTALLATION, AMOUNT OF AUXILIARY EQUIPMENT REQUIRED, AND WETTER DISCHARGE CAKE; CENTRIFUGE IS MOST VERSATILE MEANS AND REQUIRES MINIMUM OF AUXILIARY EQUIPMENT; IT HANDLES WIDE RANGE OF INLET CONSISTENCIES WITH LITTLE EFFECT ON CAKE SOLIDS CONTENT, AND IT DEWATERS TO LOWER CAKE MOISTURE THAN VACUUM FILTER; DISADVANTAGE IS PROBLEM OF WEAR PRESS WILL PRODUCE DRIEST CAKE AND BECAUSE OF SLOW OPERATING SPEDS, 2 TO 12 RPM, WILL BE MORE RESISTANT TO WEAR; DISADVANTAGE IS LIMITED NUMBER OF SLUDGE PROBLEMS TO WHICH TO CAN BE APPLIED. (EI-28860).

01335. ULTIMATE DISPOSAL OF ADVANCED WASTE TREATMENT RESIDUES.

DEAN, R.B.
TAPPI, 52(3), 457-461, 1969.

ADVANCED WASTE TREATMENT PROCESSES INCLUDE METHODS FOR REMOVING POLLUTANTS SUCH AS NUTRIENTS, SUSPENDED MATTER, DISSOLVED ORGANICS, AND SALTS FROM WASTE WATER AND CONCENTRATING THEM IN WASTE STREAM; DEVISING MOST ECONOMICAL PROCESS FOR DISPOSAL OF CONCENTRATED POLLUTANTS IS RESPOSNIBILITY OF ULTIMATE DISPOSAL RESEARCH ACTIVITIES OF FEDERAL WATER POLLUTION CONTROL ADMINISTRATION IN CINCINNATI. (EI).

01336. ION EXCHANGE FOR METAL PRODUCTS FINISHER.

KUNIN, R.
PRODUCTS FINISHING (CINCINNATI) 33(7, 8, 9), 1969, P 66-73, MAY P 71-9, JUNE P 182-4, 186-90.

HOW ION EXCHANGE OPERATES; ION EXCHANGE EQUILIBRIUM; KINETICS OF ION EXCHANGE; PERFORMANCE OF ION EXCHANGE TECHNIQUE AND ITS APPLICATIONS. FOUR TABLES LIST PROPERTIES OF ION EXCHANGE RESINS, APPROXIMATE ION EXCHANGE SELECTIVITY COEFFICIENTS, RELATIVE ION EXCHANGE RATES AND METALS RECOVERED AND PURIFIED COMMERCIALLY BY ION EXCHANGE, THEORETICAL COST OF RECOVERING METALS BY ION EXCHANGE RESINS; AVERAGE COMPOSITIONS OF VARIOUS METAL TREATMENT WASTES, HANDLING MIXED WASTES, RECOVERY OF NOBLE METALS; EQUIPMENT FOR ION EXCHANGE, TROUBLE SHOOTING. (EI-43102).

01337. WASTE TREATMENT IN METAL FINISHING-- U.S. AND EUROPEAN PRACTICES.

ZIEVERS, J.F.; CRAIN, R.W.; BARCLAY, F.G.
PLATING, 55(11), 1171-1179, 1968.

EXISTING WASTE TREATMENT REQUIREMENTS AND PRACTICES TO MEET THEM ARE DISCUSSED; COSTS INVOLVED IN MEETING VARIOUS WASTE TREATMENT REQUIREMENTS ARE GIVEN; BRIEF SURVEY IS PROVIDED OF OPERATING RESULTS AND SUGGESTIONS FOR OBSERVATIONS THAT HAVE PROVED HELPFUL IN OPERATING WASTE TREATMENT PLANTS; CONVENTIONAL VS PACKAGE PLANTS ARE DISCUSSED; UNITS ARE PLACED EITHER ABOVE GROUND, IN SUMPS AT STRETEGIC POINTS IN PLANT OR DESIGNED INTO UNDERPINNINGS OF PLATING MACHINE. (EI-50088).

01338. CHEMICAL PHYSICAL WASTEWATER RENOVATION PROCESS FOR KRAFT PULP AND PAPER WASTES.

SMITH, D.R.; BERGER, H.F.
WATER POLLUTION CONTROL FEDERATION J., 40(9) (ANNUAL CONFERENCE ISSUE), 1575-1571, 1968.

TREATMENT METHOD IS PROPOSED WHICH HANDLES WASTEWATER STEPWISE TO PRODUCE REUSABLE PROCESS WATER; FOUR STAGE PROCESS UTILIZING LIME DOSING, BIOLOGICAL TREATMENT, ACTIVATED CARBON FILTRATION, AND DEMINERALIZATION WAS USED ON BLEACHED AND UNBLEACHED KRAFT TOTAL-MILL-EFFLUENT; THREE STAGE SYSTEM WITHOUT BIOLOGICAL TREATMENT WAS ALSO TREATED; BOD AND COLOR REMOVAL WERE 97 AND 99.5%, RESPECTIVELY, FOR FOUR STAGE, AND 85.5 AND 99.5%, RESPECTIVELY, FOR THREE-STAGE; COST COMPARISONS ARE MADE. (EI-07758).

01339. KEEPING POLLUTANTS OUT OF TROUBLED WATERS.

PAULSON, E.G.
LUBRICATION ENG., 24(11), 508-513, 1968.

OIL IS MOST UNIVERSALLY ENCOUNTERED CONTAMINANT IN WASTE WATER STREAM APPEARING IN TWO BASIC FORMS FREE FLOATING OIL OR EMULSIFIED OIL SOLUTIONS; WHEN TREATING EMULSIFIED OIL, ONE OF PRIMARY STEPS IN BREAKING OF EMULSION BY ADDITION OF CHEMICALS; RESULTANT FREE OIL CAN BE REMOVED BY USAGE OF QUIESCENT SETTLING CHAMBERS, SUCH AS API SEPARATORS; OTHER DEVICES FOR OIL WASTE TREATMENT AND METHODS EMPLOYED; CONSIDERATION MSUT BE GIVEN TO ULTIMATE DISPOSAL OF COLLECTED, OIL-LADEN SLUDGE AND ECONOMICS INVOLVED IN COAGULANT RE USE SYSTEMS. (EI-10416).

01340. ENGINEERING PROCESSES FOR WASTE CONTROL.

BARKER, W.G.; SCHWARZ, D.
CHEM ENG PROGRESS, 65(1), P 58-61, 1969.

REVIEW OF WASTE TREATMENT PRACTICE OF SEVERAL FACILITIES AT ABBOTT LABORATORIES, LOCATED IN UNITED STATES AND ABROAD; DETAILED DESCRIPTION IS GIVEN OF PROCESS AND EQUIPMENT EMPLOYED TO MEET VARIOUS DIFFERENT WASTE PROBLEMS, AND ECONOMICS OF METHODS ARE EVALUATED.

01341. ADVANCED TREATMENT PROCESSES.

TCHOBANOGLOUS, G.; ELIASSEN, R.
CHEM ENG., 75(22), 95-99, 1968.

UNIT OPERATIONS AND PROCESSES INVOLVED IN WASTEWATER RECLAMATION ARE REVIEWED. TABLES LIST WASTEWATER TREATMENT PROCESSES, AND EFFICIENCY AND COST COMPARISON. FROM ECONOMIC POINT OF VIEW, ADVANCED WASTEWATER TREATMENT MUST BE CONSIDERED TWO PHASE OPERATION: SEPARATION OF CONTAMINANTS, AND DISPOSAL OF CONCENTRATED CON-

TAMINANTS. COST DATA MUST BE DEVELOPED FOR BOTH PHASES. THESE COSTS AND VALUE OF TREATED WATER WILL DETERMINE OVERALL EFFECTIVENESS OF PLAN. (EI-21896).

01342. HIGH TEMPERATURE WASTEWATER TREATMENT PROCESS.

BROWN, L.R.; LADNER, C.M.; TISCHER, R.G.
ASME-PAPER 68-WA/PID-9 FOR MEETING DEC 1-5 1968, 11 P.

WASTEWATER TREATMENT PROCESSES INVOLVING MICROBIOLOGICAL ACTIVITY ARE CARRIED OUT AT AMBIENT TEMPERATURES. IN SOME AREAS, THERMAL ENERGY IS WASTE A PRODUCT OR POTENTIALLY PROCURABLE AT EXTREMELY LOW COST. DATA ON EFFECTIVENESS OF HIGH TEMPERATURE SEWAGE TREATMENT PROCESS ARE GIVEN. TEMPERATURES STUDIED WERE 45, 55, AND 65 C. EFFICIENCIES WERE MEASURED IN TERMS OF REMOVAL OF BIOCHEMICAL OXYGEN DEMAND, CHEMICAL OXYGEN DEMAND, SUSPENDED MATTER, SETTLEABLE MATTER AND INORGANIC PHOSPHATES; RESULTS OF CONTINUOUS PROCESS INVOLVING THERMOPHILIC BACTERIAL TREATMENT ARE REPORTED. (EI-49414).

01343. A MODEL FOR ECONOMIC EVALUATION OF WATER QUALITY IN IRRIGATION.

YARON, D.; BRESLER, E.
AUSTRALIAN JOURNAL OF AGRICULTURAL ECONOMICS, 14(1), 53-62, JUNE 1970.

01344. CAPITAL AND OPERATING COSTS--ADVANCED WATER TREATMENT.

EVANS, D.R.; WILSON, J.C.
J WATER POLLUTION CONTROL FED., 44(1), 1972.

01345. AN ANNOTATED LIST OF FAO PUBLICATIONS ON INLAND WATER POLLUTION, AND WATER QUALITY AND QUANTITY WITH SPECIAL REFERENCES TO FISH LIFE 1957-1970.

DILL, W.A.
FAO FISHERIES CIRCULAR NO. 124, 1971.

01346. WATER POLLUTION IN THE GREATER NEW YORK AREA.

JOHNSON, A.A.
GORDON AND BREACH, SCIENCE PUBLISHERS, NEW YORK, 1970.

01347. EFFECT OF POLLUTION ABATEMENT IN LOS ANGELES HARBOURS.

REISH, D.J.
MARINE POLLUTION BULLETIN (GREAT BRITAIN), 1971.

01348. POLLUTION OF THE WORLD'S HARBORS, DOCKS, AND INLAND WATERWAYS, WITH PARTICULAR REFERENCE TO SHIPS.

STOKES, J.H.
MARINE TECHNOLOGY 8(13), 1971.

01349. WATER QUALITY SIMULATION MODEL.

FRANTHAM, G.R.
JOURNAL OF THE SANITARY ENGINEERING DIVISION, ASCE, 97(SA2), 569, 1971.

01350. COMPUTERIZED EVALUATION OF LIQUID WASTE ASSIMILATION.

HANN, R.W.
ENVIRONMENTAL ENGINEERING DIVISION, DEPARTMENT OF CIVIL ENGINEERING, TEXAS A & M UNIVERSITY, 1969.

01351. BOD MASS BALANCE AND WATER QUALITY STANDARDS.

WHIPPLE, W.
WATER RESOURCES RESEARCH, 6(827), 1970.

01352. LAKE AND RIVER POLLUTION, AN ANNOTATED BIBLIOGRAPHY.

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OCEAN ENGINEERING INFORMATION SERVICE, LA JOLLA, CALIFORNIA, 1971.

01353. ECONOMIC INCENTIVE FOR POLLUTION ABATEMENT: APPLYING THEORY TO PRACTICE.

REED, K.R.
ARIZONA LAW REVIEW, 12(511), 1970.

01354. THE USE OF THE FEDERAL INCOME TAX SYSTEM TO COMBAT AIR AND WATER POLLUTION: A CASE STUDY IN TAX EXPENDITURES.

KAPLINSKY, A.S.; MCDANIEL, P.R.
BOSTON COLLEGE INDUSTRIAL AND COMMERCIAL LAW REVIEW, 12(351), 1971.

01355. PROPOSED PRINCIPLES AND STANDARDS FOR PLANNING WATER AND RELATED LAND RESOURCES.

WATER RESOURCES COUNCIL.
FEDERAL REGISTER, DECEMBER 21, 1971.

01356. MODERN PROCESSES FOR WATER POLLUTION CONTROL.

DIAPER, E.W.J.; CRITIS, G.J.
ANALYTIC INSTRUMENTS, 7(261), 1969.

01357. UNIT OPERATIONS AND TREATMENT KINETICS OF WATER PURIFICATION AND WASTEWATER TREATMENT.

WARD, J.C.
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01358. THE OPTIMAL DESIGN OF WATER QUALITY MANAGEMENT SYSTEMS: AN APPLICATION

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MCNAMARA, J.R.
PH.D. THESIS, RENSSELAER POLYTECHNIC INSTITUTE, 1971.

01359. PROFITS, JOINT COSTS AND WATER QUALITY CONTROL.

HOUSLEY, C.B.
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01360. ECONOMIC EVALUATION OF FISH PROTEIN CONCENTRATE PROCESSES USING THE COST SYSTEM.

BLECKER, H.G.
ACS NATIONAL MEETING, 164TH, AUGUST 1972.

01361. OPTIMAL WASTE TREATMENT AND POLLUTION ABATEMENT BENEFITS ON A CLOSED RIVER SYSTEM.

CLOUGH, D.H.; BAYER, M.B.
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GORCZYCA, M.
JOURNAL OF THE SANITARY ENGINEERING DIVISION, ASCE, 98(SA6), 987-1003, 1972.

THE PAPER PRESENTS THE RESULTS OF STUDIES OF THE STRUCTURE AND CHANGES IN CONSTRUCTION COSTS, AS WELL AS SALES PROFITABILITY, OF WATER SUPPLY AND SEWAGE NETWORKS CONSTRUCTED FROM 1961-1970 IN WARSAW AND LODZ, POLAND. THE LEVEL OF SALE PRICES AND BUILDING COSTS OF WATER SUPPLY AND SEWAGE NETWORKS IS DETERMINED BY HYDROGEOLOGICAL CONDITIONS AND COST OF REMOVAL OF OTHER INSTALLATIONS, TECHNICAL AND OTHER SOLUTIONS USED BY CONTRACTORS, OBSTACLES MET DURING CONSTRUCTION, AND THE LEVEL OF ESTIMATED PRICES FOR CONSTRUCTION. THE PRICE LEVEL IS PLANNED BY THE STATE IN POLAND. THE INCLUDED DATA SHOW THAT THE WATER SUPPLY LINES CONSISTED OF 46% CAST IRON, AND 54% ASBESTOS CEMENT, WITH 42.1% OF 100-MM DIAMETER, 41.5% OF 150-MM DIAMETER, AND 16.4% OF 200-MM DIAMETER; FOR SEWAGE NETWORKS 30% WAS 200-MM DIAMETER, 19.4% WAS 250-MM, 31.4% WAS 300-MM DIAMETER, AND 19.2% WAS 400-MM DIAMETER.

01406. COST-EFFECTIVENESS ANALYSIS OF WASTEWATER REUSES.

CLARK, R.M.; SWEETEN, J.M.; GREATHOUSE, D.G.
JOURNAL OF THE SANITARY ENGINNEERING DIVISION, ASCE, 98(SA6), 869-881, 1972.

THE PURPOSE OF THIS PAPER IS TO DEMONSTRATE, BY MEANS OF A CASE STUDY OF WATER REUSE, THE USEFULNESS OF APPLYING KAZANOWSKI'S COST-EFFECTIVENESS APPROACH TO CIVIL ENGINEERING SYSTEMS. THIS METHOD FACILITATES EVALUATING AND COMPARING ALTERNATIVE SYSTEMS DESIGNED TO REACH A GIVEN GOAL. THE CASE STUDY IS CONCERNED WITH TWO CONCURRENT PROBLEMS THAT ARE COMMONLY FACING METROPOLITAN AREAS: SECURING AN ADEQUATE WATER SUPPLY AND DISPOSING OF THE SEWAGE EFFLUENT. SEVERAL DISTINCT ALTERNATIVE SYSTEMS TO DEAL WITH THESE PROBLEMS ARE IDENTIFIED, SUCH AS EXCHANGE FOR IRRIGATION WATER, OR TERTIARY TREATMENT AND RECYCLING. FOR EACH ALTERNATIVE SYSTEM, THE ECONOMIC ANALYSIS, THE ENVIRONMENTAL IMPACT UPON IMPLEMENTATION, AND THE HORIZONTAL AND VERTICAL EXTERNALITIES ARE EVALUATED AND PRESENTED IN TABULAR FORM. THE RESULT OF A SENSITIVITY ANALYSIS PERFORMED ON MAJOR SYSTEM VARIABLES IS GIVEN.

01407. REFUSE RECLAMATION AND RECYCLE.

MALINA, J.F.
JOURNAL OF THE SANITARY ENGINEERING DIVISION, ASCE, 98(SA6), 819-831, 1972.

VARIOUS ASPECTS OF REFUSE RECYCLE AND RECLAMATION WERE DEFINED AND EVALUATED. CURRENT RECYCLING PRACTICES WERE EVALUATED, AND THE USE OF METAL AND PAPER SALVAGE WERE CHOSEN AS MOST FEASIBLE. FIXED AND VARIABLE COSTS FOR SIX COMPONENTS OF A HYPOTHETICAL SOLID WASTE DISPOSAL AND RECYCLING SYSTEM WERE DEVELOPED FROM AVAILABLE DATA. THESE COMPONENTS ARE: SORTING, BALING, SIZE REDUCTION, MAGNETIC SEPARATION, TRANSFER, AND SANITARY LANDFILL. COMPONENT COST VARIED AS A FUNCTION OF REFUSE HANDLING CAPACITY AND PER CENT OF REFUSE RECYCLED. ALL COSTS WERE CONVERTED TO A COMMON BASE OF DOLLARS PER TON OF REFUSE PRODUCED BY DIVIDING TOTAL COST OF EACH PROCESS BY THE TOTAL TONS OF REFUSE PRODUCED DAILY IN THE AREA SERVED. THE SIX COMPONENTS WERE ASSEMBLED INTO FIVE DIFFERENT CONFIGURATIONS RANGING IN COMPLEXITY FROM A TWO-COMPONENT TRANSFER AND LANDFILL SYSTEM WITH NO RECYCLING CAPABILITY TO A 6-COMPONENT SYSTEM WITH UP TO 50% RECYCLE CAPABILITY. THE CONFIGURATIONS ARE COMPARED IN TERMS OF FLEXIBILITY, COST, AND ECONOMICAL OPERATING RANGE.

01408. OPTIMAL DESIGN OF WASTEWATER TREATMENT SYSTEMS BY ENUMERATION.

PARKIN, G.F.; DAGUE, R.R.
JOURNAL OF THE SANITARY ENGINEERING DIVISION, ASCE, 98(SA6), 833-851, 1972.

WASTEWATER TREATMENT SYSTEMS WERE DESIGNED TO ACHIEVE SPECIFIC REQUIREMENTS AT LEAST COST. THE TREND IS TO DESIGN THE MOST EFFICIENT PROCESSES. AN ENUMERATIVE MATHEMATICAL MODEL WAS USED TO EVALUATE TWO COMMON TREATMENT SYSTEMS. THE MODEL PROVIDED DESIGNS BASED ON STANDARD CRITERIA AND EVALUATED COSTS USING PUBLISHED EQUATIONS. IT WAS FOUND THAT MIXED LIQUORS SUSPENDED SOLID (MLSS) LEVELS IN ACTIVATED SLUDGE SYSTEMS SHOULD BE 3,000 MG/L. FOR PRIMARY SETTLING TANKS PRECEDING ACTIVATED SLUDGE, THE COMPUTER ALWAYS SELECTED THE LEAST EFFICIENT UNIT, IN TERMS OF BOD AND SUSPENDED SOLIDS REMOVALS. ANAEROBIC DIGESTERS WERE SELECTED OVER AEROBIC DIGESTERS IN ALL OPTIMAL DESIGNS, BUT THE COST DIFFERENCE WAS SMALL. THE MODEL IS LIMITED BY THE ALTERNATIVES CONSIDERED, THE DESIGN CRITERIA SELECTED AND THE CONSTRAINTS IMPOSED, BUT PROVIDES INSIGHT INTO THE EFFECTS OF COMMON DESIGN DECISIONS.

01409. OPTIMUM NUMBER AND LOCATION OF TREATMENT PLANTS.

CONVERSE, A.O.
J WATER POLLUTION CONTROL FED., 44, 1629-1636, 1972.

A DYNAMIC PROGRAMMING TECHNIQUE CAN BE USED TO DETERMINE AN OPTIMAL (LEAST-COST) BALANCE BETWEEN THE NUMBER OF WASTEWATER TREATMENT PLANTS AND THE EXTENT OF TRUNK SEWERS. THE COMPUTER PROGRAM PRINTS OUT THE MINIMUM COST AS A FUNCTION OF THE NUMBER OF TREATMENT PLANTS USED, AND DETERMINES THE OPTIMAL NUMBER OF PLANTS AND THE LOCATION, COST, FLOW, AND THE EXTENT OF DRAINAGE REGION FOR EACH PLANT OF THE OPTIMAL SOLUTION. TOTAL SYSTEM COST IS MOST SENSITIVE TO TREATMENT COST. THE MODEL DOES NOT TAKE INTO ACCOUNT TREATMENT PLANTS ALREADY IN OPERATION, WATER QUALITY CONSTRAINTS, AND SEVERAL OTHER FACTORS, ALTHOUGH THESE COULD BE INCLUDED IN REFINEMENTS OF THE METHOD. THE METHOD WAS TESTED ON DATA FROM THE MERRIMAC WATERSHED IN NEW HAMPSHIRE AND MASSACHUSETTS.

01410. COMPUTERIZED WATER QUALITY MANAGEMENT.

MERTEN, A.G.; FALKNER, C.H.
J WATER POLLUTION CONTROL FED., 44, 1601-1610, 1972.

AN INTERACTIVE COMPUTER PROGRAM HAS BEEN DEVELOPED TO SOLVE A CLASS OF STOCHASTIC PROGRAMMING PROBLEMS THAT ARISE IN THE DETERMINATION OF WASTE REDUCTION LEVELS ALONG A RIVER. THE PROBLEM SOLVER, SITTING AT A TELETYPE, CAN GENERATE PROPOSED REDUCTION SOLUTIONS BASED ON VARIOUS TEMPERATURE AND FLOW CONDITIONS, COSTS OF WASTE REDUCTION, AND WATER QUALITY STANDARDS. SENSITIVITY ANALYSES AND MODIFICATION OF DISPLAY OF VARIOUS DATA ELEMENTS CAN ALSO BE EXECUTED. THE INTERACTIVE PROGRAM AND A PROGRAM TO MAINTAIN THE NECESSARY PROGRAM AND DATA FILES HAVE BEEN WRITTEN. COMPUTATIONAL EXPERIENCE WITH THE SYSTEM HAS BEEN CARRIED OUT AND BEEN FOUND SATISFACTORY, WITH LIMITED COMPUTING TIME REQUIRED.

01411. OPERATIONAL AND MAINTENANCE EXPERIENCE IN SCREENING DIGESTED SLUDGE.

GARBER, W.F.; OHARA, G.T.
JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, 44, 1518-1526, 1972.

ALL DIGESTED SLUDGE SOLIDS PRODUCED AT THE HYPERION TREATMENT PLANT, LOS ANGELES, CALIFORNIA, ARE PASSED THROUGH 6-MESH (2.36-MM CLEAR OPENING) SCREENS BEFORE DISPOSAL THROUGH A PIPELINE INTO 310 FT (94.5 M) OF WATER AT THE HEAD OF A SUBMARINE CANYON. SOME OF THE SCREENINGS ARE DISPOSED OF IN SANITARY LANDFILLS. AN AVERAGE OF 336,000 LB/DAY (153,000 KG/DAY) OF DIGESTED SLUDGE SOLIDS ARE SCREENED WITH ABOUT 31,000 LB/DAY (14,400 KG/DAY) OF SCREENING REMOVED. THE SLUDGE SOLIDS ARE 58.5 PER CENT VOLATILE SOLIDS, AND ABOUT 80 PER CENT ARE LESS THAN 200-MESH (0.074-MM CLEAR OPENING) IN SIZE. TWO TYPES OF SCREENS ARE USED, AND ANNUAL OPERATIONAL AND MAINTENANCE COSTS RANGE BETWEEN $3,500 AND $4,000/UNIT. THE PROPOSED ODOR CONTROL UNIT UTILIZES BIOLOGICAL TREATMENT.

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01461. NORTHERN CALIFORNIA'S WATER INDUSTRY: THE COMPARATIVE EFFICIENCY OF PUBLIC ENTERPRISE IN DEVELOPING A SCARCE NATURAL RESOURCE.

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JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND, 1967.

01462. THE TREATMENT OF INDUSTRIAL WASTES.

BESSELIEVRE, E.B.
MCGRAW-HILL PUBL CO, NEW YORK, 1969.

01463. A STATEMENT OF THE PROBLEM--ENVIRONMENTAL QUALITY CONTROL.

BROOKS, D.L.
BIOSCIENCE, 17, 873, 1967.

01464. PROCEEDINGS: 16TH SOUTHERN WATER RESOURCES AND POLLUTION CONTROL CONFERENCE.

BRYAN, E.H. (ED..
DUKE UNIVERSITY, DEPARTMENT OF CIVIL ENGINEERING, DURHAM, NORTH CAROLINA, 1967.

01465. THE ORSANCO STORY: WATER QUALITY MANAGEMENT IN THE OHIO VALLEY UNDER AN INTERSTATE COMPACT.

CLEARY, E.J.
JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND, 1967.

01466. SCIENCE AND SURVIVAL.

COMMONER, B.
VIKING PUBL CO, NEW YORK, 1966, 150 P.

01467. CONGRESSIONAL WHITE PAPER ON A NATIONAL POLICY FOR THE ENVIRONMENT.

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS, U.S. SENATE; COMMITTEE ON SCIENCE AND ASTRONAUTICS, U.S. HOUSE OF REPRESENTATIVES, 90TH CONGRESS.
U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C., 1968.

01468. CONSERVATION AND THE RATIONAL USE OF THE ENVIRONMENT.

BULLETIN OF THE INTERNATIONAL HYDROLOGICAL DECADE, 4, JUNE 1968.

01469. THE COST OF CLEAN WATER.

ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 257, APRIL 1968.

01470. WATER MANAGEMENT INNOVATIONS IN ENGLAND.

CRAINE, L.E.
JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND, 1969, 123 P.

01471. THE RANGE OF CHOICE IN WATER MANAGEMENT: A STUDY OF DISSOLVED OXYGEN IN THE POTOMAC ESTUARY.

DAVIS, R.K.
JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND, 1968, 196 P.

01472. THE POLLUTION READER.

DEVOS, A.; PEARSON, N.; SILVESTON, P.L.; DRYNAN, W.R.
HARVEST HOUSE, MONTREAL, CANADA, 1968, 264 P.

01473. THE ECONOMICS OF ENVIRONMENTAL MANAGEMENT--PANEL DISCUSSION.

AMERICAN ECONOMIC REVIEW/PAPERS AND PROCEEDINGS, 58, MAY 1968.

01474. ECONOMICS AND ENVIRONMENT.

GALBRAITH, J.K.
AMER INST ARCH J, 55, SEPTEMBER 1966.

01475. A THEORETICAL NOTE ON THE CAPACITY OF THE MARKET SYSTEM TO ABATE POLLUTION.

GRAMM, W.P.
LAND ECONOMICS, AUGUST 1969.

01476. ECOLOGICAL APPROACH TO CONSERVATION.

HAMM, R.L.; NASON, L.
BURGESS PUBL CO, MINNEAPOLIS, MINNESOTA, 1964.

COST ANALYSIS OF WATER POLLUTION CONTROL

01477. QUALITY OF THE ENVIRONMENT: AN ECONOMIC APPROACH TO SOME PROBLEMS IN USING LAND, WATER AND AIR.

HERFINDAHL, O.C.; KNEESE, A.V.
JOHNS HOPKINS PRESS, BALTIMORE, 1965.

01478. SOME EFFLUENT PROBLEMS OF OUR AFFLUENT SOCIETY.

KIROV, N.
CLEAN AIR, 2(3), SEPTEMBER 1968.

01479. WHY WATER POLLUTION IS ECONOMICALLY UNAVOIDABLE.

KNEESE, A.V.
TRANS-ACTION, 31, APRIL 1968.

01480. MANAGING WATER QUALITY: ECONOMICS, TECHNOLOGY, INSTITUTIONS.

KNEESE, A.V.; BOWER, B.B.
JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND, 1968, 328 P.

01481. ECONOMICS OF WATER RECLAMATION.

KNEESE, A.V.; FRANKEL, R.J.
PROCEEDINGS, CONSERVATION AND RECLAMATION OF WATER SYMPOSIUM, INSTITUTE OF WATER POLLUTION CONTROL, LONDON, 1967.

01482. WATER RESEARCH.

KNEESE, A.V.; SMITH, S.C.
JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND, 1966.

01483. SOME ENVIRONMENTAL EFFECTS OF ECONOMIC DEVELOPMENT.

KRUTILLA, J.V.
DAEDALUS, 96, 1058, FALL 1967.

01484. THE COSTS OF ECONOMIC GROWTH.

MISHAN, E.J.
PRAEGER PUBL. CO, WASHINGTON, D.C., 1967.

01485. RESOURCE ECONOMICS AND A QUALITY ENVIRONMENT, MAN VERSUS ENVIRONMENT, MONOGRAPH NO. 3.

NATIONAL SANITATION FOUNDATION, SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN, 1965.

01486. RESTORING THE QUALITY OF OUR ENVIRONMENT.

THE ENVIRONMENTAL POLLUTION PANEL, PRESIDENT'S SCIENCE ADVISORY COMMITTEE.
THE WHITE HOUSE, WASHINGTON, D.C., NOVEMBER 1965.

01487. THE QUALITY OF THE HUMAN ENVIRONMENT, APPENDIX 3, IN WASTE MANAGEMENT RESEARCH AND ENVIRONMENTAL QUALITY MANAGEMENT: HEARINGS.

REVELLE, R.
HEARINGS, SUBCOMMITTEE AIR AND WATER POLLUTION, COMM. PUBLIC WORKS, U.S. SENATE, 90TH CONGRESS, WASHINGTON, D.C., 1968.

01488. QUALITY OF THE ENVIRONMENT AND MAN: SOME THOUGHTS ON ECONOMIC INSTITUTIONS.

SCHMID, A.A.
JOURNAL SOIL AND WATER CONSERVATION, 21, 89, MAY 1966.

01489. POLLUTION AND POVERTY: THE STRATEGY OF THE CROSS-COMMITMENT.

STARR, R.; CARLSON, J.
THE PUBLIC INTEREST, WINTER 1968, 104-131.

01490. BENEFIT-COST ANALYSIS FOR WATER RESOURCE PROJECTS.

HINOTE, H.
UNIVERSITY OF TENNESSEE, NASHVILLE, JUNE 1969.

01491. CENTRAL PACIFIC BASINS PROJECT, SAN JOAQUIN MASTER DRAIN.

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D.C., JANUARY 1967.

THE STUDY EVALUATES THE DETRIMENTAL EFFECTS OF INCREASED NITROGEN AND SALINITY LEVELS RESULTING FROM DISCHARGE OF A PROPOSED MASTER DRAIN FOR AGRICULTURAL RETURN FLOWS. DAMAGES ASSESSED INCLUDE IMPACTS ON RECREATION, NAVIGATION, AND INDUSTRIAL USES.

01492. COLORADO RIVER SALINITY STUDY.

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D.C., 1968.

THIS (UNPUBLISHED) STUDY UTILIZED INPUT-OUTPUT ANALYSIS TO DETERMINE ECONOMIC EFFECTS OF CHANGES IN SALINITY LEVELS MEASURING DAMAGES AS CHANGES IN GROSS REGIONAL PRODUCT ADJUSTED FOR DIRECT WATER COSTS.

01493. ECONOMIC CONSIDERATIONS OF WATER POLLUTION CONTROL.

BAXTER, S.S.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 37, 1363-1369, OCTOBER 1965.

THE PROBLEMS OF THE ECONOMICS INVOLVED IN THE DISPOSAL OF USED WATER ARE DISCUSSED, AND THE FOLLOWING FOUR INTER-RELATED QUESTIONS ARE CONSIDERED: (1) WHAT ARE THE PURPOSES AND USES WHICH WE EXPECT OF RECEIVING STREAMS? (2) WHAT ARE THE ACTUAL BENEFITS AND IMPROVEMENTS WHICH WILL OCCUR IN THE STREAM IF A HIGHER DEGREE OF TREATMENT IS USED? (3) WHAT ARE THE RELATIONS BETWEEN THE COSTS INVOLVED AND THE BENEFITS WHICH WILL BE

DERIVED FROM DIFFERENT DEGREES OF TREATMENT? (4) WHAT ARE THE RELATIONS OF THESE COSTS AND BENEFITS TO THE COSTS AND BENEFITS OF OTHER CIVIC PROGRAMS? IN CONSIDERING BENEFITS AND IMPROVEMENTS, THE BENEFIT-COST RATIO MUST BE RELATED TO THE USES A COMMUNITY DESIRES FOR ITS STREAMS.

01494. METHODOLOGY FOR APPROACHING WATER QUALITY PROBLEMS, IN WATER RESOURCES AND ECONOMIC DEVELOPMENT OF THE WEST.

BOWER, B.T.
WESTERN AGRICULTURAL ECONOMICS RESEARCH COUNCIL, COMMITTEE ON THE ECONOMICS OF WATER RESOURCES DEVELOPMENT, CONFERENCE PROCEEDINGS, LAS VEGAS, NEVADA, DECEMBER, 1966, PP. 67-88.

THE AUTHOR BEGINS BY EMPHASIZING THAT WATER QUALITY PROBLEMS ARE TO BE VIEWED IN THE OVERALL FRAMEWORK OF WATER RESOURCES MANAGEMENT, THAT WATER QUALITY CANNOT BE DIVORCED FROM CONSIDERATIONS OF WATER QUANTITY, AND THAT A REGIONAL POINT OF VIEW WILL BE ADOPTED. HE CLASSIFIES THE RELEVANT RELATIONSHIPS INTO THREE BROAD CATEGORIES: PHYSICAL, ENGINEERING AND ECONOMIC. THESE RELATIONSHIPS ARE IMPORTANT TO THE INDIVIDUAL USER AND TO THE REGION AS A WHOLE. THE RELATIONSHIPS, AS THEY AFFECT THE INDIVIDUAL USER, ARE ILLUSTRATED BY REFERENCE TO MUNICIPAL, IRRIGATION, RECREATIONAL AND INDUSTRIAL WATER USES. EXAMPLES OF IMPORTANT QUALITY PARAMETERS IN EACH OF THESE USES ARE DISCUSSED. IN CONSIDERING THE EFFECTS OF WATER QUALITY RELATIONSHIPS UPON THE REGIONAL ECONOMY, BOTH THE DIRECT AND INDIRECT COSTS OF MAINTAINING A CERTAIN LEVEL OF WATER QUALITY ARE CONSIDERED. THE RELATIVE DIFFICULTY OF ESTIMATING INDIRECT COSTS IS INDICATED. THE STATE OF METHODOLOGY IN ASSESSING WATER QUALITY EFFECTS UPON REGIONAL ECONOMIES IS FURTHER ILLUSTRATED BY REFERENCE TO SOME CURRENT OR RECENTLY COMPLETED STUDIES IN THIS AREA. IMPORTANT METHODOLOGICAL NEEDS ARE DISCUSSED IN THE CONCLUDING OBSERVATIONS.

01495. ECONOMICS OF WATER POLLUTION CONTROL.

CASTLE, E.N.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 38: 789-793, MAY 1966.

THE MAIN ISSUES TO BE KEPT IN MIND WHEN ECONOMIC ANALYSES ARE APPLIED TO WATER QUALITY PROBLEMS ARE OULINED. PRINCIPALLY, THESE ARE: (1) ECONOMIC VALUES CAN ONLY BE PLACED UPON SOME OF THE OBJECTIVES OF INDIVIDUALS AND OF SOCIETY AND (2) THE POINT OF VIEW ADOPTED IS OF CONSIDERABLE IMPORTANCE. IN ADDITION, A MARKET ECONOMY AS RELATED TO WATER QUALITY MANAGEMENT IS DISCUSSED IN TERMS OF EXTERNAL DISECONOMIES. TWO SUB-ISSUES RELATING TO THE REMOVAL OF THESE EXTERNAL DISECONOMIES ARE DISCUSSED. ONE RELATES TO THE APPROPRIATE DECISION ONCE THE EXTERNAL COSTS ARE KNOWN, AND THE OTHER PERTAINS TO THE APPROPRIATE TECHNIQUE OR INSTITUTION TO BRING THIS ABOUT. VARIOUS TECHNIQUES OR INSTITUTIONAL ARRANGEMENTS ARE EXAMINED; THE BASIN-WIDE OR REGIONAL ORGANIZATION APPEARS TO HAVE THE MOST ADVANTAGES, SINCE IT PERMITS THE VARIOUS PARTIES CONCERNED TO PARTICIPATE IN THE DECISION-MAKING PROCESS. REFERENCE IS MADE TO A 17-SECTOR MODEL OF THE ECONOMY OF THE YAQUINA BAY IN OREGON TO TRACE THE EFFECTS OF DIFFERENT WATER QUALITY MANAGEMENT PROGRAMS ON THE ECONOMY OF A LOCAL AREA.

01496. BENEFIT-COST CONSIDERATIONS IN WATER QUALITY MANAGEMENT.

CLEARY, E.J.
PUBLIC WORKS, 94, 66, 68, 70, DECEMBER 1963.

THIS ARTICLE PRESENTS CRITICISM OF ANALYSTS OF THE CORPS OF ENGINEERS FOR FAILING TO DEMONSTRATE, IN THEIR PROPOSALS OF STORAGE RESERVOIRS FOR THE POTOMAC RIVER BASIN, (1) THAT THE BENEFITS FOR THE $500 MILLION PROPOSED EXPENDITURE WERE JUSTIFIABLE AND (2) THAT ADEQUATE CONSIDERATION WAS GIVEN TO ALTERNATIVE WAYS OF DEALING WITH THE POLLUTION PROBLEM. THE AUTHOR ASSERTS THAT THE CORPS ASSUMED CERTAIN STANDARDS OF CLEANLINESS THAT MUST BE MET AND THEN DERIVED BENEFITS ON THE BASIS OF REACHING THESE STANDARDS BY THE LEAST COSTLY SINGLE-PURPOSE SYSTEM. THERE ARE TWO FALLACIES IN THIS PROCEDURE: (1) IT CONSTITUTES ADOPTION OF PHYSICAL STANDARDS WITHOUT ANY ANALYSIS OF THE ECONOMIC CONSEQUENCES INVOLVED AND (2) THE MEASURE OF BENEFITS DEPENDS ENTIRELY UPON THE COST OF THE SO-CALLED LEAST COSTLY ALTERNATIVE, E. G., LOW-FLOW AUGMENTATION, WHICH MAY NOT BE ANY MEASURE OF THE PUBLIC'S WILLINGNESS TO PAY FOR THE SERVICE.

01497. POLLUTION: THE PROBLEM OF EVALUATION. PROCEEDINGS OF THE NATIONAL CONFERENCE ON WATER POLLUTION, WASHINGTON, D.C., DECEMBER 12-14, 1960.

FOX, I.K.
PUBLIC HEALTH SERVICE, U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, 1961, PP. 114-119.

FOX ARGUES THAT A SOUND BASIS FOR THE DESIGN OF PUBLIC POLICIES AND PROGRAMS FOR WATER QUALITY MANAGEMENT REQUIRES A FRAMEWORK FOR ANALYSIS THAT WILL PROVIDE A RELATIVELY PRECISE UNDERSTANDING OF BENEFITS AND COSTS--'WE DO NOT HAVE SUCH A FRAMEWORK TODAY.' HIS MAJOR OBJECTIVE IS TO IDENTIFY FIVE MAJOR ELEMENTS OF THE PROBLEM: (1) A CLASSIFICATION OF THE KINDS OF WATER QUALITY DETERIORATION WHICH IS USEFUL FOR PURPOSES OF BENEFIT-COST ANALYSIS, (2) PRECISE DEFINITION OF THE DIFFERENT KINDS OF VALUES INVOLVED IN WATER QUALITY MANAGEMENT, E. G., DIFFERENTIATION BETWEEN HEALTH VALUES, AESTHETIC VALUES AND MARKET VALUES, ONLY THE LAST OF WHICH CAN BE MEASURED IN MONETARY TERMS, (3) AN ACCOUNTING OF THE PHYSICAL AND BIOLOGICAL ASPECTS, (4) CONSIDERATION OF TECHNOLOGICAL CHANGE AND (5) AN ACCOUNTING OF THE POLITICAL INSTITUTIONS THROUGH WHICH ACTION IS ACHIEVED. CONSIDERING THE GENERAL STRUCTURE OF THE PROBLEM, SOME LINES OF STUDY DEEMED HELPFUL IN THE DESIGN OF A SYSTEM OF WATER QUALITY EVALUATION ARE BRIEFLY REVIEWED.

01498. WATER SUPPLY: ECONOMICS, TECHNOLOGY, AND POLICY.

HIRSHLEIFER, J.; DEHAVEN, J.C.; MILLIMAN, J.W.
UNIVERSITY OF CHICAGO PRESS, CHICAGO, ILLINOIS, 1960, 378 P.

THE AUTHORS DISCUSS WATER QUALITY AS A PARAMETER OF WATER AVAILABILITY. THE COST AND VALUE OF WATER QUALITY IS DISCUSSED. AN ATTEMPT IS MADE TO SHOW THAT QUALITY CONSIDERATIONS CAN AND MUST

BE QUANTIFIED IN ECONOMIC TERMS BEFORE A PROPER ANALYSIS CAN BE MADE.

01499. ECONOMICS OF POLLUTION CONTROL IN WATER RESOURCES AND ECONOMIC DEVELOPMENT IN THE SOUTH. CONFERENCE ON WATER RESOURCES AND ECONOMIC DEVELOPMENT, ATLANTA, 1965.

KNEESE, A.V.

COUNCIL OF STATE GOVERNMENTS, SOUTHERN LAND ECONOMICS RESEARCH COMMITTEE AND THE AGRICULTURAL POLICY INSTITUTE, AUGUST 1965, PP 97-107.

THE APPROACHES THAT HAVE BEEN TAKEN IN THE UNITED STATES TO SOLVE THE FIRST MAJOR PROBLEM OF WATER QUALITY MANAGEMENT--OPTIMAL CONTROL OF WASTE DISCHARGES FROM INDIVIDUAL WASTE DISPOSERS--ARE PRESENTED. BASED ON COMMENTS ON THE ECONOMIC IMPLICATIONS OF THESE DEVICES, THE CONCLUSION IS THAT THERE ARE INHERENT LIMITATIONS IN THE TECHNIQUES WHICH HAVE BEEN RELIED UPON FOR POLLUTION ABATEMENT. THESE LIMITATIONS ARE SUMMARIZED. IN VIEW OF THESE LIMITATIONS, THE AUTHOR STATES THAT WE SHOULD MOVE TOWARD THE CREATION OF REGIONAL AGENCIES WITH FAR REACHING POWERS TO PLAN, CONSTRUCT, OPERATE AND FINANCE REGIONAL SYSTEMS OF WASTE DISPOSAL. THE ORGANIZATIONAL IMPLICATIONS OF SUCH AN AGENCY ARE THEN DISCUSSED.

01500. SOCIO-ECONOMIC ASPECTS OF WATER QUALITY MANAGEMENT.

KNEESE, A.V.

JOURNAL WATER POLLUTION CONTROL FEDERATION, 36: 254-262, FEBRUARY 1964.

THIS PAPER BEGINS WITH A DISCUSSION OF FIVE INTERDEPENDENT CONCEPTS WHICH SHOULD BE EMPHASIZED IN A GENERAL DEFINITION OF THE NATURE AND SCOPE OF WATER QUALITY MEASUREMENTS. THE WRITER THEN DISCUSSES 'AN OPERATIONAL THEORY OF SOCIAL VALUES,' A DIFFICULT PROBLEM AREA IN EVALUATING WATER USES AFFECTED BY WATER MANAGEMENT. HE CONCLUDES THAT PROGRESS IS BEING MADE TOWARD SPECIFIC EVALUATION OF MANY ASPECTS OF WATER RESOURCES DEVELOPMENT THAT WERE FORMERLY CONSIDERED INTANGIBLE. WHERE EXPLICIT MEASUREMENT OF VALUE IS LACKING, THE DESIRED RESULTS CAN BE INCORPORATED INTO OPTIMIZATION MODELS IN THE FORM OF CONSTRAINTS OR STANDARDS.

01501. WATER POLLUTION: ECONOMIC ASPECTS AND RESEARCH NEEDS.

KNEESE, A.V.

RESOURCES FOR THE FUTURE, INC., WASHINGTON, D.C., 1962, 107 P.

PART I IS DEVOTED TO AN ECONOMIC FRAMEWORK FOR POLLUTION CONTROL. IT OUTLINES A CONCEPTUAL FOUNDATION FOR PUBLIC POLICY WHICH HELPS TO IDENTIFY AREAS IN WHICH RESEARCH COULD IMPROVE THE PLANNING PROCESS OF WATER POLLUTION CONTROL. THE APPENDICES TO CHAPTER IV ARE DEVOTED TO: (1) BENEFIT-COST ANALYSIS AND THE 'CONSTRAINED COST MINIMIZATION' FRAMEWORK, A GENERAL STATEMENT, IN TERMS OF BENEFITS AND COSTS, AND (2) PROPERTY VALUES. CHANGES IN PROPERTY VALUES ARE DEEMED INADEQUATE AND POSSIBLY HIGHLY DECEPTIVE REPRESENTATIONS OF THE REAL GAINS FROM POLLUTION CONTROL.

01502. FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1961. PUBLIC LAW NO. 87-88.

87TH CONGRESS, 1ST SESSION, JULY 20, 1961.

THE FOLLOWING IS ADDED TO SECTION II OF THE WATER POLLUTION CONTROL ACT: (B) (1) IN THE SURVEY OF PLANNING OF ANY RESERVOIR BY THE CORPS OF ENGINEERS, BUREAU OF RECLAMATION, OR OTHER FEDERAL AGENCY, CONSIDERATION SHALL BE GIVEN TO THE INCLUSION OF STORAGE FOR REGULATION OF STREAM FLOW FOR THE PURPOSE OF WATER QUALITY CONTROL, EXCEPT THAT ANY SUCH STORAGE AND WATER RELEASES SHALL NOT BE PROVIDED AS A SUBSTITUTE FOR ADEQUATE TREATMENT OR OTHER METHODS OF CONTROLLING WASTE AT THE SOURCE. (2) THE NEED FOR THE VALUE OF STORAGE FOR THIS PURPOSE SHALL BE DETERMINED BY THESE AGENCIES, WITH THE ADVICE OF THE SECRETARY AND HIS VIEWS ON THESE MATTERS SHALL BE SET FORTH IN ANY REPORT OR PRESENTATION TO THE CONGRESS PROPOSING AUTHORIZATION OR CONSTRUCTION OF ANY RESERVOIR INCLUDING SUCH STORAGE. (3) THE VALUE OF SUCH STORAGE SHALL BE TAKEN INTO ACCOUNT IN DETERMINING THE ECONOMIC VALUE OF THE ENTIRE PROJECT OF WHICH IT IS A PART, AND COSTS SHALL BE ALLOCATED TO THE PURPOSE OF WATER QUALITY CONTROL IN A MANNER WHICH WILL ENSURE THAT ALL PROJECT PURPOSES SHARE EQUITABLY IN THE BENEFITS OF MULTIPLE-PURPOSE CONSTRUCTION. (4) COST OF WATER QUALITY CONTROL FEATURES INCORPORATED IN ANY FEDERAL RESERVOIR OR OTHER IMPOUNDMENT UNDER THE PROVISIONS OF THIS ACT SHALL BE DETERMINED AND THE BENEFICIARIES IDENTIFIED AND, IF THE BENEFITS ARE WIDESPREAD OR NATIONAL IN SCOPE, THE COST OF SUCH FEATURES SHALL BE NONREIMBURSABLE.

01503. PROPOSED PRACTICES FOR ECONOMIC ANALYSIS OF RIVER BASIN PROJECTS.

U.S. INTER-AGENCY COMMITTEE ON WATER RESOURCES. SUB-COMMITTEE ON EVALUATION STANDARDS.

U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C., MAY 1958, 56 P.

IN CHAPTER II ARE PRESENTED THE BASIC PRINCIPLES AND CONCEPTS FOR ECONOMIC ANALYSIS INCLUDING THE EVALUATION OF BENEFITS AND COSTS. CHAPTER IV INCLUDED A DISCUSSION OF THE APPLICATION OF THE PRINCIPLES TO VARIOUS PROJECT PURPOSES--WATER POLLUTION CONTROL IS PRESENTED.

01504. THE SOCIAL VALUE OF WATER RECREATIONAL FACILITIES RESULTING FROM AN IMPROVEMENT IN WATER QUALITY: THE DELAWARE ESTUARY IN WATER RESEARCH. EDITED BY A.V. KNEESE AND S.C. SMITH.

DAVIDSON, P.; ADAMS, F.G.; SENECA, J.

JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND, 1966, PP. 175-211.

AN ANALYTICAL APPROACH TO COMPARE THE BENEFITS AND COSTS OF WATER RECREATIONAL FACILITIES FROM WATER QUALITY IMPROVEMENTS IS EXPLORED. THIS APPROACH INVOLVES EMPIRICAL ESTIMATION OF THE ACTUAL AND POTENTIAL USE OF FACILITIES AT VARIOUS

LEVELS OF WATER PURITY. THE RESULTS OF THIS STUDY SERVE AS THE BASIS TO ILLUSTRATE A BENEFIT-COST ANALYSIS OF WATER QUALITY IMPROVEMENT FOR THE DELAWARE RIVER ESTUARY.

01505. A COST OPTIMIZATION STUDY FOR STREAM WASTE DISPOSAL. (UNPUBLISHED).

DRIVER, E.E.; MCBEATH, C.B.; ELIASSEN, R.
ANNUAL SYMPOSIUM OF THE NORTHERN CALIFORNIA SECTION OF THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, APRIL 19, 1966, 31 P.

THE AUTHORS DEVELOP A METHOD FOR DETERMINING THE MINIMUM COST OF MAINTAINING A SPECIFIED QUALITY STANDARD FOR A STREAM RECEIVING INDUSTRIAL WASTES. THE SYSTEM DESCRIBED CONSISTS OF ONE STREAM RECEIVING WASTES FROM TWO SEPARATE SOURCES. THE DISSOLVED OXYGEN CONCENTRATION OF THE RECEIVING WATER IS USED AS THE PARAMETER FOR MEASURING STREAM QUALITY; TO MAKE IT MORE REALISTIC, THE METHOD CAN BE MODIFIED TO INCLUDE ANY PARAMETERS CONSIDERED APPLICABLE TO THE QUALITY OF THE STREAM. THE ONLY REQUIREMENT FOR MODIFICATION TO INCLUDE OTHER PARAMETERS IS THAT THE BEHAVIOR OF THE POLLUTANT CAN BE DESCRIBED BY MATHEMATICAL MODELS. THE OUTCOME OF THIS ANALYSIS IS A RELATIONSHIP BETWEEN STREAM QUALITY STANDARDS AND THE COST OF TREATMENT REQUIRED TO MAINTAIN THESE STANDARDS.

01506. THE MEASUREMENT OF WATER QUALITY BENEFITS.

DUTTA, M.; ASCH, P.
RUTGERS UNIVERSITY, BUREAU OF ECONOMIC RESEARCH, NEW BRUNSWICK, NEW JERSEY, MAY 1966, 130 P.

THIS REPORT, ADDRESSED TO THE GENERAL PROBLEM OF MEASURING THE BENEFITS ASSOCIATED WITH WATER QUALITY IMPROVEMENT, IS DIVIDED INTO THREE MAJOR PARTS. IN PART I, 'ANALYTICAL FRAMEWORK, ' THE AUTHORS DISCUSS THE MECHANISM OF THE MARKET, THE ROLE OF GOVERNMENT, GUIDELINES FOR POLICY AND THE USE OF BENEFIT-COST ANALYSIS. PART II IS DEVOTED TO THE 'BENEFITS DERIVED FROM WATER QUALITIES' IN WHICH THE GENERAL MEASUREMENT PROBLEM AND THE IDENTIFICATION OF BENEFITS AND APPROACHES TO MEASUREMENT ARE DISCUSSED. THREE CLASSES OF BENEFITS ARE IDENTIFIED: (1) LOSS-AVOIDANCE BENEFITS WHICH INCLUDE IRRIGATION AND FLOOD CONTROL, WATER TREATMENT COSTS (INDUSTRIAL AND MUNICIPAL), PROPERTY DAMAGE AND LOSS OF VALUE, AND PUBLIC HEALTH; (2) OTHER READILY-MEASURED BENEFITS WHICH INCLUDE COMMERCIAL FISHING, FARMING AND RELATED BUSINESSES, AND OTHER INDUSTRIES; (3) RECREATION AND AESTHETICS. PART III, 'MEASURING THE DEMAND FOR WATER QUALITY-BASED RECREATION, ' RECEIVED THE HEAVIEST EMPHASIS BECAUSE IT 'REFLECTS THE WRITERS' CONCLUSION THAT THIS AREA MAY WELL PROVE DECISIVE IN ASSESSING POLLUTION ABATEMENT PROGRAMS. '

01507. INDUSTRIAL BENEFITS DERIVED FROM IMPROVED RAW WATER QUALITY IN THE CONTRA COSTA CANAL.

ELIASSEN, R.; ROWLAND, W.F.
STANFORD UNIVERSITY, INSTITUTE IN ENGINEERING-ECONOMIC SYSTEMS, STANFORD, CALIFORNIA, SEPTEMBER 1962, 22 P.

THIS STUDY UTILIZED THE 'WITH' AND THE 'WITHOUT' APPROACH EMPLOYING THE REDUCTION OF COST AS A MEASURE OF WATER QUALITY BENEFITS. INDIVIDUAL AND OVERALL INDUSTRIAL WATER QUALITY PENALTY COSTS WERE CALCULATED FROM DATA (FOR THE YEAR 1961 WITHOUT KELLOGG RESERVOIR) ON ANNUAL COST, COST PER ACRE-FOOT OF CANAL WATER REQUIRING ADDITIONAL TREATMENT AND COST PER ACRE-FOOT OF ANNUAL CANAL USAGE. THE TOTAL EXCESS CHLORIDE CONTENT WAS THEN DETERMINED FOR THE PERIODS OF THE YEAR DURING WHICH THE CANAL WATER CHLORIDE CONTENT EXCEEDED 100 PPM, WITH THIS VALUE BEING CONVERTED TO AN AVERAGE ANNUAL VALUE. THE EQUIVALENT UNIT PENALTY COST PER ACRE-FOOT OF TOTAL INDUSTRIAL CANAL USAGE PER PPM AVERAGE EXCESS CHLORIDE WAS THEN DETERMINED. ANTICIPATED AVERAGE ANNUAL CONTRA COSTA CANAL WATER CHLORIDE REDUCTIONS RESULTING FROM THE OPERATING OF THE KELLOGG RESERVOIR WERE THEN DETERMINED. EACH OF THESE VALUES WAS MULTIPLIED BY THE EQUIVALENT UNIT PENALTY COST TO OBTAIN THE UNIT BENEFITS, OR ALLEVIATED PENALTY COST PER ACRE-FOOT OF CANAL WATER USAGE.

01508. POLLUTION ABATEMENT. GUIDE TO BENEFIT-COST ANALYSIS. REPORT BASED ON RESOURCES FOR TOMORROW CONFERENCE, MONTREAL, OCTOBER 23-28, 1961.

SEWELL, W.R.D.; DAVIS, J.; ROSS, D.W.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY, OTTAWA, CANADA, 1965, 30 P.

MOST OF THE BENEFITS OF POLLUTION ABATEMENT PROJECTS FALL INTO THE CATEGORY OF 'INTANGIBLES' IN THE SENSE THAT A PRICE IS NOT USUALLY CHARGED FOR THE SERVICES PROVIDED. NEVERTHELESS, EVALUATION OF POLLUTION ABATEMENT PROJECTS IS POSSIBLE BY A BENEFIT-COST ANALYSIS. BENEFITS CAN BE ASSESSED EITHER BY COMPARISON OF COST OF ALTERNATIVE WAYS OF PROVIDING THE SERVICE OR BY METHODS SUGGESTED IN THE SECTIONS OF THE REPORT ON RECREATION AND INTANGIBLE BENEFITS. BECAUSE OF THE DIFFICULTY OF QUANTIFYING BENEFITS, IT MAY BE NECESSARY IN SOME CASES TO REDUCE THE PROBLEM TO MERE COMPARISON OF THE COST OF VARIOUS METHODS OF ACHIEVING VARIOUS LEVELS OF POLLUTION CONTROL. MORE GENERALLY, HOWEVER, IT SHOULD BE POSSIBLE TO MEASURE THE BENEFITS OF CONTROL IN ONE LOCATION BY USING THE MINIMUM COST OF ACHIEVING THE SAME ABATEMENT OF POLLUTION IN ANOTHER LOCATION OR BY ANOTHER METHOD. SOMETIMES THE CHOICE IS NOT BETWEEN TWO LOCATIONS FOR TREATMENT BUT BETWEEN TREATMENT (OR CONTROL) AND NO CONTROL. THEN THE BENEFIT-COST RATIO BETWEEN THE SITUATION 'WITH' AND 'WITHOUT' THE CONTROL SHOULD BE DETERMINED. THUS, THE BENEFIT FOR POLLUTION CONTROL IN THIS STUDY MAY BE MEASURED IN ONE OF THREE WAYS: (1) ALTERNATIVE COST OF PROVIDING THE SERVICE, (2) INCREMENTAL COST OF INCREASING THE SCALE OF THE PROJECT AND (3) COSTS INCURRED 'WITH' OR 'WITHOUT' THE PROJECT.

01509. WATER USE RELATIONAHIPS AS AFFECTED BY WATER QUALITY ON THE YAQUINA BAY. WESTERN RESOURCES CONFERENCE PAPERS, 1964.

STOEVENER, H.H.
UNIVERSITY OF COLORADO PRESS, BOULDER, COLORADO, 1965, PP. 87-89.

THIS IS A REPORT OF AN ATTEMPT TO APPLY ECONOMIC LOGIC TO AN ACTUAL SITUATION. THE PROBLEM IS ONE

OF A PULP MILL DISCHARGING WASTE INTO AN ESTUARY. ACCORDING TO ONE ARGUMENT, THE RESULTING LOWER QUALITY HAS A NEGATIVE EFFECT ON THE HARVEST OF FISH FOR RECREATIONAL AND COMMERCIAL PURPOSES. ON THE OPPOSITE SIDE IS THE ARGUMENT FOR THE REGIONAL BENEFITS RESULTING FROM INDUSTRIALIZATION. FOR PRIMARY BENEFITS, THE EFFECTS OF WATER QUALITY ON ANGLER EFFORT CAN BE DERIVED. GIVEN THE RELEVANT PRICE VARIABLE FOR THE DEMAND FUNCTION, THE REDUCTION IN NET ECONOMIC VALUE IS DETERMINED SUBJECT TO THE REDUCTION IN ANGLER EFFORT. FOR SECONDARY BENEFITS, THE AUTHOR ATTEMPTS TO MEASURE THE BENEFITS ASSOCIATED WITH THE VARIOUS LEVELS OF WATER POLLUTION CONTROL IN THE FRAMEWORK OF AN INTERINDUSTRY MODEL. THE RESULTS OF THE ANALYSIS ARE NOT GIVEN IN THIS REPORT.

01510. POLICIES, STANDARDS, AND PROCEDURES IN THE FORMULATION, EVALUATION, AND REVIEW OF PLANS FOR USE AND DEVELOPMENT OF WATER AND RELATED LAND RESOURCES.

U.S. SENATE, 87TH CONGRESS, DOCUMENT NO. 97.
U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C., 1962.

THIS DOCUMENT INCLUDED A DISCUSSION OF THE PRIMARY BENEFITS OF WATER QUALITY CONTROL AND STANDARDS FOR THE MEASUREMENT OF THESE BENEFITS. THE NET CONTRIBUTION MAY BE EVALUATED IN TERMS OF AVOIDANCE OF ADVERSE EFFECTS WHICH WOULD ACCRUE IN THE ABSENCE OF WATER QUALITY CONTROL, INCLUDING SUCH DAMAGES AND RESTRICTIONS AS PRECLUSION OF ECONOMIC ACTIVITIES, CORROSION OF FIXED AND FLOATING PLANTT, LOSS OR DOWNGRADING OF RECREATIONAL OPPORTUNITIES, INCREASED MUNICIPAL AND INDUSTRIAL WATER TREATMENT COSTS, LOSS OF INDUSTRIAL AND AGRICULTURAL PRODUCTION, IMPAIRMENT OF HEALTH AND WELFARE, DAMAGE TO FISH AND WILDLIFE, SILTATION, SALINITY INTRUSION, AND DEGRADATION OF THE AESTHETICS OF ENJOYMENT OF UNPOLLUTED SURFACE WATERS, OR, CONVERSELY, IN TERMS OF THE ADVANTAGEOUS EFFECTS OF WATER QUALITY CONTROL WITH RESPECT TO SUCH ITEMS. EFFECTS SUCH AS THESE MAY BE COMPOSITED ROUGHLY INTO TANGIBLE AND INTANGIBLE CATEGORIES, AND USED TO EVALUATE DIRECTLY THE ECONOMIC EFFECTS OF WATER QUALITY IMPROVEMENT, THE COST OF ACHIEVING THE SAME RESULTS BY THE MOST LIKELY ALTERNATIVE MAY BE USED AS AN APPROXIMATION OF VALUE.

01511. METHODS OF APPROXIMATING DILUTION WATER REQUIREMENTS AS A SUPPLEMENTAL MEASURE FOR CONTROL OF WATER QUALITY IN RIVERS.

U.S. SENATE, SELECT COMMITTEE FOR NATIONAL WATER RESOURCES, 86TH CONGRESS.
U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C., 1960, 28 P.

THIS REPORT CONTAINS A SECTION ON ESTIMATING COST OF TREATMENT, FOR VARYING DEGREES OF TREATMENT.

01512. PROPOSED PRACTICES FOR ECONOMIC ANALYSIS OF RIVER BASIN PROJECTS.

U.S. INTER-AGENCY COMMITTEE ON WATER RESOURCES, SUBCOMMITTEE ON EVALUATION STANDARDS.
U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C., MAY 1958, 56 P.

ON THE MEASUREMENT OF BENEFITS FOR WATER POLLUTION CONTROL, THE SUBCOMMITTEE DOCUMENT STATES: IN THE ABSENCE OF MARKET DETERMINED VALUES TO SERVE IN THE MEASUREMENT OF WATER POLLUTION CONTROL BENEFITS, ECONOMIC INDICATORS OF THE WORTH OF POLLUTION ABATEMENT MUST BE SOUGHT IN DERIVED MEASURES OF VALUE. SUCH MEASURES INCLUDE THE COST OF THE MOST ECONOMICAL ALTERNATIVE MEANS OF ACCOMPLISHING COMPARABLE EFFECTS, THE DECREASE IN EXPENDITURES BY COMMUNITIES AND BUSINESS ESTABLISHMENTS FOR WATER TREATMENT, AND IMPROVEMENT IN RECREATIONAL FACILITIES, SUCH AS BOATING, SWIMMING, AND FISHING, ATTRIBUTABLE TO IMPROVED WATER QUALITY AND QUANTITY. THERE IS ALSO NEED FOR EXTENDING THE SCOPE OF MEASUREMENT PRACTICES BY DEVISING SIMULATED MARKET CONDITIONS TO ESTABLISH A VALUE FOR POLLUTION ABATEMENT COMPARABLE TO THAT ATTAINED FOR OTHER PROJECT PURPOSES.

01513. THE ECONOMICS OF WATER QUALITY. PROCEEDINGS OF THE FIRST ANNUAL MEETING OF THE AMERICAN WATER RESOURCES ASSOCIATION.

WHIPPLE, W. JR.
AMERICAN WATER WORKS ASSOCIATION, URBANA, ILLINOIS, DECEMBER 1965, PP. 225-242.

01514. WATER QUALITY MANAGEMENT--THE PLANNING OF ECONOMICALLY OPTIMAL POLLUTION CONTROL SYSTEMS. PROCEEDINGS OF THE FIRST ANNUAL MEETING OF THE AMERICAN WATER RESOURCES ASSOCIATION.

DEININGER, R.A.
AMERICAN WATER RESOURCES ASSOCIATION, URBANA, ILLINOIS, DECEMBER 1965, PP. 254-282.

THIS PAPER BEGINS WITH A BRIEF PRESENTATION OF PAST PURPOSES OF WATER CONSERVATION AND DEVELOPMENT, WHICH HAVE BEEN CONCERNED ALMOST ENTIRELY WITH WATER QUALITY. PAST EFFORTS OF PROJECT EVALUATION IN THIS AREA ARE PRESENTED. THE WRITER STATES THAT, WHILE STUDIES OF WATER-QUANTITY MANAGEMENT ARE ESSENTIAL, THE PROBLEMS OF THE FUTURE WILL MAKE WATER-QUALITY MANAGEMENT MORE IMPORTANT. AN EXAMPLE IS PRESENTED TO ILLUSTRATE THE MANNER IN WHICH SYSTEMS ANALYSIS (OR OPERATIONS RESEARCH) CAN BE APPLIED TO WATER-QUALITY MANAGEMENT PROBLEMS. THE APPLICABILITY OF THIS APPROACH IS DEMONSTRATED BY THE USE OF MODELS CONTAINING ONLY ONE WATER-QUALITY PARAMETER. WHTHIN THIS FRAMEWORK, APPLICABLE MATHEMATICAL MODELS (NAMELY LINEAR PROGRAMMING AND INTEGER PROGRAMMING) ARE DESCRIBED. THESE MODELS ARE THEN USED IN A NUMERICAL EXAMPLE TO INVESTIGATE THE BEHAVIOR OF THE SOLUTIONS OVER A RANGE OF POLLUTION CRITERIA IN A HYPOTHETICAL RIVER BASIN. ALTHOUGH THE EXAMPLE USED IN THIS STUDY CONTAINS ONLY ONE QUALITY PARAMETER, IT IS DESIRABLE TO USE ADDITIONAL CONSTRAINTS WHICH CAN BE DERIVED AND ADDED TO THE

ONE-CONSTRAINT PROBLEM. THROUGH THE PROPER USE OF SUCH MODELS, THE ECONOMICS ASSOCIATED WITH ALL ASPECTS OF STREAM QUALITY CAN BE EVALUATED.

01515. ECONOMIC EVALUATION OF WATER QUALITY: AN ENGINEERING-ECONOMIC MODEL FOR WATER QUALITY MANAGEMENT.

FRANKEL, R.J.
UNIVERSITY OF CALIFORNIA, SANITARY ENGINEERING RESEARCH LABORATORY, BERKELEY, CALIFORNIA, JANUARY 1965, 167 P.

THE EFFECTS OF DOMESTIC SEWAGE DISPOSAL ON THE QUALITY OF RECEIVING WATERS AND THE TREATMENT OF THESE WATERS FOR MUNICIPAL WATER SUPPLY FORM THE CORE OF THE ENGINEERING-ECONOMIC ANALYSIS OF THIS STUDY. THE AUTHOR DETERMINES IN ECONOMIC TERMS THE OPTIMUM DIVISION OF TREATMENT BETWEEN THE WASTE TREATMENT PLANT OF ONE COMMUNITY AND THE WATER TREATMENT PLANT OF ANOTHER, AND EVALUATES THE ECONOMIC EFFECTS OF IMPOSING VARIOUS WATER QUALITY STANDARDS ON THE WASTE-STREAM, WATER-SUPPLY SYSTEM TO MEET THE NEEDS OF OTHER BENEFICIAL USES. A COMPUTER MODEL IS DEVELOPED TO SIMULATE A WATER COURSE OF SPECIFIED CHARACTERISTICS AND SUBJECT TO FLOW REGULATION AT ITS HEADQUARTERS. WITHIN THE UPSTREAM AREA, A COMMUNITY OF SPECIFIED SIZE DISCHARGES DOMESTIC SEWAGE INTO A STREAM. DOWNSTREAM A SECOND COMMUNITY DRAWS UPON THE STREAM FOR ITS WATER SUPPLY. BETWEEN THE TWO COMMUNITIES, THE STREAM IS SUBJECT TO NATURAL SELF-PURIFICATION AND IS UNDER THE JURISDICTION OF A REGULATORY AGENCY EMPOWERED TO IMPOSE QUALITY STANDARDS DEEMED NECESSARY FOR THE PROTECTION OF OTHER BENEFICIAL USES OF THE STREAM. THE APPLICATION OF THE COMPUTER TECHNIQUES IS THEN USED TO DETERMINE THE EFFECTS OF THE VARIABLES OF THE SYSTEM ON THE COST OF WATER RE-USE. THE RELATIVE EFFECTS OF NEWER TECHNOLOGIES AND THE RECLAMATION OF SEWAGE EFFLUENT ON THE OVERALL COSTS OF THE WASTE STREAM WATER RE-USE SYSTEM ARE LIKEWISE EXPLORED. THUS, THE ECONOMIC ANALYSIS IS MADE ON THE BASIN OF ALTERNATIVE COST COMPARISONS UTILIZING THE COMPUTER MODEL TO INVESTIGATE ALTERNATIVES.

01516. AN ECONOMIC APPROACH TO WATER QUALITY CONTROL. PAPER PRESENTED AT THE 38TH ANNUAL CONFERENCE OF THE WATER POLUTION CONTROL FEDERATION, ATLANTIC CITY, NEW JERSEY, OCTOBER 10-14, 1965.

KERRY, K.D.
JOURNAL WATER POLLUTION CONTROL FEDERATION, 38: 1883-1897, DECEMBER 1966.

AN ECONOMIC MODEL ANALYZING COSTS OF TREATING WASTE DISCHARGES AND THE NATURAL PURIFICATION CAPACITY OF THE RECEIVING WATERS IS PRESENTED. USE OF THE MODEL DETERMINES THE DEGREE OF TREATMENT REQUIRED OF EACH WASTE DISCHARGER IN ORDER TO ACHIEVE A DESIRED WATER QUALITY OBJECTIVE AT THE MINIMUM COST TO ALL DISCHARGERS IN THE AFFECTED REGION. THE ANALYTICAL MODEL CONSISTS OF TWO DIGITAL COMPUTER PROGRAMS WHICH (A) DETERMINE THE MINIMUM COST FOR REMOVAL OF A DEFINITE QUANTITY OF OXYGEN-CONSUMING WASTES THROUGH A CRITICAL REACH IN A RIVER AND (B) PREDICT THE RESPONSE OF THE DISSOLVED OXYGEN CONCENTRATION IN THE RIVER TO THE WASTE DISCHARGES RESULTING FROM THE MINIMUM-COST SOLUTION. THE MINUMUM-COST SOLTUION IS OBTAINED FROM A DISSOLVED OXYGEN COST OF TREATMENT MATRIX SOLVED BY NON-LINEAR PROGRAMMING TECHNIQUES. THIS SOLUTION IS INSERTED IN THE STREETER-PHELPS OXYGEN SAG EQUATION FOR A PREDICTION OF THE DISSOLVED OXYGEN PROFILE OF THE RIVER BEING STUDIED.

01517. AN INVESTIGATION OF ALTERNATIVE MEANS OF ACHIEVING WATER QUALITY OBJECTIVES.

KERRI, K.D.
PH.D. THESIS, OREGON STATE UNIVERSITY, CORVALLIS, OREGON, JUNE 1966, 177P.

THE OBJECTIVE OF THIS WORK IS TO TEST THE HYPOTHESIS THAT 'THE WATERS OF THE WILLIAMETTE RIVER BASIN ARE TOO COSTLY FOR POLLUTION ABATEMENT. ' THE WORD 'COSTLY' REFERS TO THE COST OF PROVIDING DILUTION WATER TO ACHIEVE WATER QUALITY OBJECTIVES. THE PROCEDURE IS TO DETERMINE THE MINIMUM COST OF (1) ACHIEVING OR MAINTAINING WATER QUALITY OBJECTIVES BY THE TREATMENT OF WASTE WATERS AT THEIR SOURCE AND (2) A COMBINATION OF WASTE WATER TREATMENT AT ITS SOURCE AND THE STORAGE OF WATER FOR DILUTION PURPOSES DURING CRITICAL LOW FLOW PERIODS. IF THE MINIMUM-COST METHOD OF ACHIEVING THE WATER QUALITY OBJECTIVES IS WASTE WATER TREATMENT, THE HYPOTHESIS IS ACCEPTED. THE WATER QUALITY OBJECTIVES ARE VARIOUS LEVELS OF DISSOLVED OXYGEN AND COLIFORM BACTERIA. THE RANGE OF VALUES SELECTED FOR THESE OBJECTIVES INDICATED MINIMUM ABATEMENT COST TRENDS FOR DIFFERENT COMBINATIONS OF WATER QUALITY OBJECTIVES. TO ASCERTAIN THE DEGREE OF WASTE TREATMENT REQUIRED OF AL THE UPSTREAM DISCHARGES, A COST MATRIX IS DEVELOPED AND THE MINIMUM COST DETERMINED USING NONLINEAR PROGRAMMING TECHNIQUES. TO ACHIEVE OR MAINTAIN COLIFORM BACTERIA MPN OBJECTIVES, THE CRITICAL REACH IS BELOW EACH OUTFALL AND THE COSTS ARE DETERMINED BY AN ANALYSIS OF EACH INDIVIDUAL OUTFALL; IN REGIONS OF NUMEROUS DISCHARGES, THE COST MATRIX IS UTILIZED. THE FLOWS IN THE RIVER ARE REGULATED BY RELEASES FROM A SYSTEM OF RESERVOIRS. THE MINIMUM FLOWS AND AMOUNTSOF STORAGE REQUIRED FOR DILUTION DURING DIFFERENT DESIGN PERIODS ARE ESTIMATED BY DISTRIBUTION-FREE OR NON-PARAMETRIC METHODS.

01518. THE OPTIMAL ALLOCATION OF STREAM DISSOLVED OXYGEN.

LIEBMAN, J.C.; LYNN, W.R.
WATER RESOURCES RESEARCH, 2: 581-591, THIRD QUARTER, 1966.

TWO FORMS OF PROTECTIVE STANDARDS PROPOSED AND IMPLEMENTED BY REGULATORY AGENCIES ARE DISCUSSED: THE STREAM STANDARD AND THE EFFLUENT STANDARD. THIS PAPER IS ADDRESSED TO THE LIMITED PROBLEM OF FINDING A MINIMUM COST WAY OF MEETING A SET OF STREAM DISSOLVED OXYGEN STANDARDS. THE QUESTION TO BE ANSWERED IS: GIVEN A SET OF STANDARDS THAT SPECIFY MINIMUM DISSOLVED OXYGEN CONCENTRATIONS IN VARIOUS PARTS OF A STREAM, WHAT AMOUNT OF BOD REMOVAL SHOULD BE REQUIRED FROM EACH OF THE DISCHARGERS FOR THE DISSOLVED OXYGEN STANDARDS TO BE MET AT MINIMUM TOTAL COST OF TREATMENT? A DYNAMIC PROGRAMMING MODEL THAT MINIMIZES THE COST OF PROVIDING WASTE TREATMENT TO MEETI SPECIFIED DISSOLVED OXYGEN CONCENTRATION STANDARDS IN A STREAM IS DEVELOPED. THE MODEL IS SOLVED ON THE BASIN OF DATA FROM THE WILLIAMETTE RIVER. SOME IMPLICATIONS OF THE MODEL ON POLICY FORMULATION ARE ALSO DISCUSSED.

01519. LINEAR PROGRAMMING MODELS FOR WATER POLLUTION CONTROL.

LOUCKS, D.P.; REVELLE, C.S.; LYNN, W.R.
MANAGEMENT SCIENCE, 14: B-166 TO B-188, DECEMBER 1967.

TWO DETERMINISTIC LINEAR PROGRAMMING MODELS ARE PRESENTED FOR DETERMINING THE AMOUNT OF WASTEWATER TREATMENT REQUIRED TO ACHIEVE, AT MINIMUM COST, ANY PARTICULAR SET OF STREAM DISSOLVED OXYGEN STANDARDS WITHIN A RIVER BASIN. THIS WORK EXTENDS AND SIMPLIFIES EARLIER WORKS THAT APPLIED MATHEMATICAL PROGRAMMING TO THIS PROBLEM. THE SOLUTION OF THESE MODELS INDICATES THE DESIGN EFFICIENCIES REQUIRED FOR EACH WASTEWATER TREATMENT FACILITY IN ORDER TO MAINTAIN ANY SPECIFIED SET OF STREAM DISSOLVED OXYGEN CONCENTRATIONS. THE MODELS CAN BE USED TO EVALUATE THE SENSITIVITY OF COST AND QUALITY TO ANY CHANGES IN THESE FLOW CONDITIONS AS WELL AS CHANGES IN THE PHYSICAL OR ECONOMIC PARAMETERS. THEY CAN ALSO BE USED TO DETERMINE THOSE LOCATIONS ALONG A STREAM WHERE THE DISCHARGE OF ADDITIONAL WASTEWATER EFFLUENT RESULTS IN A MINIMUM REDUCTION OF DISSOLVED OXYGEN OR A MINIMUM INCREASE IN THE TOTAL COST OF THE REQUIRED WASTEWATER TREATMENT. AN EXAMPLE ILLUSTRATES THE USE OF THESE MODELS.

01520. USE OF SYSTEMS ANALYSIS IN ESTUARINE WATER POLLUTION CONTROL. WESTERN RESOURCES CONFERENCE PAPERS, 1964.

THOMANN, R.V.
UNIVERSITY OF COLORADO PRESS, BOULDER, COLORADO, 1965, PP. 47-59.

OPTIMAL WATER POLLUTION CONTROL IS DEFINED AS 'THE CONTROL OF MAN'S ENVIRONMENT THROUGH AN OPERATIONAL SCHEME OF CONTROL MEASURES SO AS TO ACHIEVE A DESIRED WATER-USE GOAL IN AN OPTIMAL FASHION.' THE CRITERION USED IN THIS OPTIMUM DESIGN IS LEAST COST OF IMPLEMENTATION. THE PROBLEMS CAN BE FORMULATED AND SOLVEDIN AN ANALYTICAL FASHION THROUGH THE USE OF (1) A MATHEMATICAL MODEL OF THE ENVIRONMENT USING SYSTEMS ANALYSIS OR DYNAMIC CONTROL SYSTEM THEORY AND (2) THE USE OF A LINEAR PROGRAMMING FORMULATION TO ACHIEVE WATER QUALITY GOALS AT LEAST COST USING THE MATHEMATICAL DESCRIPTION. THIS PAPER IS DEVOTED TO A DISCUSSION OF THESE TOOLS AND HOW THEY CAN BE USED IN WATER POLLUTION CONTROL. THESE TECHNIQUES PROVIDE USEFUL SOLUTIONS TO THE COMPLEX INTERACTIONS THAT EXIST BETWEEN THE ENVIRONMENT, THE STREAM AND THE ECONOMY OF A GIVEN AREA. THAT IS, THE VARIOUS CAUSE-AND-EFFECT RELATIONSHIPS EXISTING BETWEEN THE ENVIRONMENT AND WATER QUALITY CAN BE SATISFACTORILY DESCRIBED USING SYSTEMS ANALYSIS. FURTHER USE OF THESE TECHNIQUES IN A LINEAR PROGRAMMING FORMULATION RESULTS IN LEAST-COST SOLUTIONS TO OBTAIN DESIRED LEVELS OF QUALITY.

01521. WATER QUALITY MANAGEMENT BY REGIONAL AUTHORITIES IN THE RUHR AREA WITH SPECIALIZED EMPHASIS ON THE ROLE OF COST ASSESSMENT.

KNEESE, A.V.
REGIONAL SCIENCE ASSOCIATION PAPERS AND PROCEEDINGS, 1963, PP. 229-250.

THE AUTHOR'S AIM IS TO PROVIDE A BRIEF REVIEW AND ASSESSMENT OF THE REGIONAL QUALITY MANAGEMENT ACTIVITIES OF THE WATER AUTHORITIES IN THE RUHR AREA, GERMANY. SPECIAL EMPHASIS IS PLACED ON THE METHODS USED TO JOIN THE SYSTEM PLANNING AND OPERATION ACTIVITIES DIRECTLY UNDER THEIR CONTROL WITH (OFTEN EQUALLY IMPORTANT) DECISIONS IMPINGING UPON WATER QUALITY BUT WHICH ARE UNDER THE CONTROL OF OTHER PRIVATE AND PUBLIC OR SEMI-PUBLIC DECISIONMAKERS. THE COST ASSESSMENT AND DISTRIBUTION METHODS USED HAVE PLAYED A PROMINENT ROLE IN THIS REGARD.

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01534. THE WATER RESOURCES OF CHILE; AN ECONOMIC METHOD FOR ANALYZING A KEY RESOURCE IN A NATION'S DEVELOPMENT.

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01535. PERCEPTION OF CHOICE AND FACTORS AFFECTING INDUSTRIAL WATER SUPPLY DECISIONS IN NORTHEASTERN ILLINOIS.

WONG, S.T.
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01640. HISTORY OF DESALTING, OPERATION, MAINTENANCE, AND COST EXPERIENCE AT BUCKEYE, ARIZONA.

SCHEFFER, S.L.
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EARLY IN 1971 THE OFFICE OF SALINE WATER SPONSORED A STUDY WITH THE AWWA RESEARCH FOUNDATION TO REVIEW THE IMPACT OF DESALTING TECHNOLOGY ON COMMUNITY WATER SUPPLIES. OPERATING EXPERIENCES AT VARIOUS DESALTING PLANTS IN THE UNITED STATES PROVIDED VALUABLE BACKGROUND FOR THIS STUDY. A REVIEW OF THE EXPERIENCES WITH THE BUCKEYE ELECTRODIALYSIS PLANT WAS MADE AS A PART OF THIS PROGRAM..

01641. ECONOMICS OF ION-EXCHANGE TECHNIQUES FOR MUNICIPAL WATER-QUALITY IMPROVEMENT.

BRESLER, S.A.; MILLER, E.F.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 64(11), 764-771, 1972.

PRELIMINARY INVESTIGATIONS INDICATE THAT MODIFIED ION-EXCHANGE PROCESSES OR COMBINED ION-EXCHANGE AND MEMBRANE PROCESSES MAY BE COMPETITIVE WITH ELECTRODIALYSIS AND REVERSE OSMOSIS IN IMPROVING THE QUALITY OF SOME BRACKISH MUNICIPAL WATER SUPPLIES. THESE PROCESSES ARE DESCRIBED AND A COST METHODOLOGY IS PRESENTED.

01642. COMPUTERIZED PROCEDURE FOR ESTIMATING COSTS OF DESALTING SYSTEMS.

DURTZ, D.L.; HUNTSINGER, R.C.; HATCH, J.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 64(11), 741-745, 1972.

COMPUTER MODELS ARE INTRODUCED AS ECONOMICAL TOOLS FOR EVALUATING FEASIBILITY AND COSTS OF SEVERAL WATER-DESALTING METHODS FOR A GIVEN APPLICATION.

01643. WATER SUPPLY FROM ESTUARIAL SOURCES.

MONTANARI, F.W.; BRENNAN, L.M.
JOURNAL AMERICAL WATER WORKS ASSOCIATION, 64(11), 761-763, 1972.

SOME COMMUNITIES MAY FIND IT NECESSARY TO DRAW FROM BRACKISH SOURCES IN ORDER TO BALANCE SUPPLY WITH DEMAND--EVEN FOR BRIEF, INFREQUENT PERIODS. ELECTRODIALYSIS CAN BE USED TO IMPROVE THE DISSOLVED SOLIDS MAKEUP OF THE WATER. THE AUTHORS REPORT ON A PARTICULAR MODEL FOR PREDICTING THE OPERATING COSTS OF AN INTERMITTENTLY FUNCTIONING ELECTRODIALYSIS PLANT.

01644. THE ECONOMICS OF URBAN SEWAGE DISPOSAL.

DOWNING, P.B.
PRAEGER PUBLISHERS, NEW YORK, N.Y., 1969, 195 P.

01645. EXTENSION OF SEWER SERVICE AT THE URBAN-RURAL FRINGE.

DOWNING, P.B.
LAND ECONOMICS, 45, 103-110, FEBRUARY 1969.

01646. THE BENEFIT-COST ANALYSIS OF ENVIRONMENTAL POLLUTION.

KNEESE, A.V.
RESOURCES FOR THE FUTURE, INC., WASHINGTON, D.C., DECEMBER 1970.

01647. USE OF DISTILLED SEA WATER AT SAN DIEGO.

DODSON, R.E.; MULFORD, S.F.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 57(9), 1965, 1106-1112.

SOME OF THE PROBLEMS ENCOUNTERED IN THE OPERATION OF THE POINT LOMA SEA WATER CONVERSION PLANT IN SAN DIEGO ARE DISCUSSED. THE MULTI-STAGE FLASH PROCESS EMPLOYED BY THE POINT LOMA PLANT IS BRIEFLY DESCRIBED. SOME COST INFORMATION IS GIVEN.

01648. PROCEEDINGS WATER RESOURCES ECONOMICS CONFERENCE.

WATER RESOURCES CENTER, UNIVERSITY OF CALIFORNIA, LOS ANGELES, SEPTEMBER 30-OCTOBER 2, 1964.

THIS REPORT DISCUSSES RECOMMENDATIONS FOR RESEARCH AND EDUCATION IN THE SOCIAL SCIENCE ASPECT OF WATER RESOURCES. THE RECOMMENDATIONS REPRESENT THE CONCENSUS OF A GROUP OF ECONOMISTS, LAWYERS, POLITICAL SCIENTISTS, AND ENGINEERS IN ATTENDANCE AT THE WATER RESOURCES ECONOMICS CONFERENCE AT LAKE TAHOE, CALIFORNIA.

01649. WATER DESALINATION: PROPOSALS FOR A COSTING PROCEDURE AND RELATED TECHNICAL AND ECONOMIC CONSIDERATIONS.

DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS OF THE UNITED NATIONS, NEW YORK, N.Y., 1965, 56 P.

PROPOSALS ON A SIMPLIFIED PROCEDURE FOR OBTAINING AN APPROXIMATE BUT REASONABLY REALISTIC COST FOR PRODUCT WATER PRODUCED BY DESALINATION ARE MADE IN THIS STUDY.

01650. FUNDAMENTAL CONSIDERATIONS IN RATES AND RATE STRUCTURES FOR WATER AND SEWAGE WORKS.

AMERICAN SOCIETY OF CIVIL ENGINEERS; MUNICIPAL LAW SECTION OF THE AMERICAN BAR ASSOCIATION.
OHIO STATE LAW JOURNAL, SPRING 1951, 276 P.

THIS REPORT DISCUSSES THE QUESTION OF HOW A UTILITY SHOULD, WHETHER PUBLICLY OR PRIVATELY OWNED, COMPUTE AND ESTABLISH FAIR RATES AND RATE STRUCTURES FOR WATER AND SEWAGE WORKS. PRESENT METHODS OF FIXING RATES ARE DISCUSSED, AND THEIR VAGARIES REVEALED. SOME SUGGESTIONS AS TO METHODS AND PROCEDURES FOR COMPUTING RATES AND

RATE STRUCTURES IN ACCORDANCE WITH THE PRINCIPLES DEVELOPED IN THIS STUDY ARE INCLUDED.

01651. WASTE WATER RENOVATION: PART 1. A DESIGN STUDY OF FREEZING AND GAS HYDRATE FORMATION. PART 2. FEASIBILITY TESTS OF FREEZING.

BARDUHN, A.J.; ROSE, A.; SWEENEY, R.F.
U.S. PUBLIC HEALTH SERVICE, PUBLICATION NO. 999-WP-4, WASHINGTON, D.C., 1963, 45 P.

THIS ARTICLE DISCUSSES THE RENOVATION OF MUNICIPAL WASTE WATERS BY AN ADOPTION OF THE FREEZING AND GAS HYDRATE PROCESSES USED IN THE DEMINERALIZATION OF SEA WATER. THE AUTHOR PREDICTS COSTS FOR RECOVERING 92 PER CENT OF THE FEED AS POTABLE WATER (250 PPM TDS). PRELIMINARY COST ESTIMATES INDICATE THAT 95 PER CENT OF THE FEED WATER CONTAINING 10 PER CENT OF THE CONTAMINANTS CAN BE RECOVERED AT A COST SOMEWHAT LOWER THAN THAT PREDICTED FOR DESALINATING SEA WATER BY FREEZING.

01652. DUAL WATER SYSTEMS.

HANEY, P.D.; HAMANN, C.L.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 57(9), 1965, 1073-1098.

THE FEASIBILITY OF USING DUAL WATER SYSTEMS TO FURNISH HIGH QUALITY WATER FOR DRINKING AND OTHER HOME USES IS EXAMINED. THIS ARTICLE IS DEVELOPED ON THE BASIS OF EQUALITY, WITH REGARD TO SAFETY, BETWEEN THE TWO SUPPLIES. COMPARATIVE COST STUDIES OF COMPLETE WATER SYSTEMS THAT EMPLOY CONVENTIONAL AND DUAL DISTRUBUTION SYSTEMS ARE INCLUDED.

01653. SOME ECONOMIC ISSUES IN WATER RIGHTS.

CIRIACY-WANTRUP, S.V.
JOURNAL OF FARM ECONOMICS, 37(5), 1955, 875-885.

THIS PAPER FOCUSES ON THE ECONOMIC ISSUES IN WATER RIGHTS--ESPECIALLY THOSE ISSUES THAT ARE CREATED BY ECONOMIC CHANGE. THE FLEXIBILITY OF THE RIPARIAN DOCTRINE, AND THE RIGIDITY OF THE APPROPRIATION DOCTRINE ARE DISCUSSED.

01654. ECONOMIC ASPECT OF INDUSTRIAL EFFLUENT TREATMENT.

CARON, A.L.
TAPPI, 47(9), 1964, PP. 62A, 67A, 72A.

THIS PAPER DEALS WITH THE COST OF PURIFICATION OF EFFLUENTS FROM THE PULP AND PAPER INDUSTRY. AN ENGINEERING STUDY AND COST ANALYSIS THAT COMPARES ALTERNATIVES IN IN-PLANT CHANGES, SITE, SEWERING, FOLLOWED BY SELECTION OF THE MOST ECONOMICAL AND SATISFACTORY SOLUTION IS THE ONLY WAY AN INDIVIDUAL MILL CAN ARRIVE AT A CLOSE ESTIMATE OF ITS OWN PROBABLE COSTS.

01655. ESTIMATED COST OF DESALTING THREE FLORIDA BRACKISH WATERS.

BARNHILL, K.G.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 54(5), 1962, 526-528.

THE ESTIMATED COSTS OF DESALTING THREE FLORIDA BRACKISH WATERS BY ELECTRODIALYSIS ARE PRESENTED. THE AUTHOR POINTS OUT THAT DESALINATION COSTS RELATE DIRECTLY TO WATER TYPE.

01656. ECONOMIC ASPECTS OF SALINE-WATER CONVERSION.

LAMB, J.C. III.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 54(7), 1962, 781-788.

THE ECONOMICS OF DESALINATION ARE REVIEWED LEADING TO NINE CONCLUSIONS RELATING TO THE STATUS OF SALINE-WATER CONVERSION. CHIEF AMONG THESE ARE THAT DESALINATION WILL NOT SIGNIFICANTLY SUPPLEMENT THE NATIONAL WATER SUPPLY IN THE FORESEEABLE FUTURE, BUT THAT IT MAY BE AN IMPORTANT SOLUTION TO WATER SUPPLY PROBLEMS IN LOCAL SITUATIONS.

01657. COST OF WATER TREATMENT IN CALIFORNIA.

ORLOG, G.T.; LINDORF, M.R.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 50(1), 1958, 45-55.

IT IS THE INTENT OF THIS ARTICLE TO PRESENT THE PICTURE OF WATER TREATMENT COSTS AS THEY EXIST IN CALIFORNIA, TO INDICATE THE TRENDS IN COST AS A FUNCTION OF PLANT CAPACITY AND RATE OF INCREASE OF WATER PRODUCTION, AND TO ILLUSTRATE THE RELATIVE IMMPORANCE OF EXPENDITURES FOR TREATMENT, WATER IMPORTATION, SEA WATER CONVERSION, AND WASTE WATER RECLAMATION.

01658. VALUE OF AN ACRE-FOOT OF WATER.

RENSHAW, E.F.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 50(3), 1958, 303-309.

THE ARTICLE STATES THAT THE DEMAND FOR VARIOUS TYPES OF WATER HAS BEEN THE SUBJECT OF SEVERAL STUDIES. AN ATTEMPT IS MADE TO SUMMARIZE INFORMATION ON VALUES OF WATER IN SUCH A WAY THAT COMPARISONS CAN BE MADE WITHIN AND BETWEEN SEVEN WATER USE CATEGORIES.

01659. A BRIEF SURVEY OF THE TECHNOLOGY AND ECONOMICS OF WATER SUPPLY.

DEHAVEN, J.C.; GORE, L.A.; HIRSHLEIFER, J.
THE RAND CORPORATION, SANTA MONICA, CALIFORNIA, REPORT R-258-RC, OCTOBER 1953, 55 P.

THIS REPORT IS A SURVEY OF THE TECHNOLOGICAL AND ECONOMIC FACTS GOVERNING WATER SUPPLIES AND DEMANDS, BOTH ACTUAL AND POTENTIAL. THE REPORT BEGINS BY EXAMINING THE HYDROLOGIC CYCLE. WATER SUPPLIES AND REQUIREMENTS IN THE LOS ANGELES REGION ARE USED TO COMPARE THE FEASIBILITY AND ECONOMIC ADVANTAGES OF VARIOUS SOURCES OF ADDITIONAL FRESH WATER. THEORETICAL ASPECTS AND ESTIMATES OF COSTS OF PRODUCING FRESH WATER FROM SALINE BY KNOWN PROCESSES IS EXAMINED. OTHER MEASURES FOR CONSERVING OR EXPANDING NATURAL WATER RESOURCES ARE EXPLORED AND COMPARED IN COST TO DESALINATION.

REFERENCE LIST

01660. CONSERVATION AND RESOURCE PROGRAMMING. PAPER PRESENTED AT SYMPOSIUM, PROGRAMMING THE USE OF NATURAL RESOURCES.

CIRIACY-WANTRUP, S.V.
ANNUAL MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, SECTION E (GEOGRAPHY AND GEOLOGY), NEW YORK, N.Y., DECEMBER 30, 1960, 105-111.

THE AUTHOR STATES THAT AT FIRST SIGHT, IT WOULD APPEAR THAT THE TECHNIQUES OF FORMAL PROGRAMMING WOULD BE HIGHLY USEFUL FOR DETERMING THE OPTIMUM STATE OF CONSERVATION. HOWEVER, THERE ARE SIGNIFICANT CONCEPTUAL AND OPERATIONAL DIFFICULTIES THAT LIMIT THE USEFULNESS OF QUANTITATIVE OPTIMIZING IN THE ECONOMICS OF CONSERVATION. HE DISCUSSES THESE DIFFICULTIES AS THREE INTERRELATED PROBLEM AREAS: VALUATION, INSTITUTIONAL CONSTRAINTS, AND UNCERTAINTY, WHICH ARE PRESENT IN THE PROGRAMMING OF ALL NATURAL RESOURCES.

01661. UTILITY DEPRECIATION PROBLEMS AND PROCEDURES.

WELMON, W.C.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 53(4), 1961, 413-420.

THE AUTHOR DISCUSSES DEPRECIATION AS IT AFFECTS WATER UTILITIES. THE RECOGNITION OF REPLACEMENT DEPRECIATION FOR TAX PURPOSES AND IN THE DETERMINATION OF RATES WOULD PERMIT UTILITIES TO RECOVER COST IN THE SAME MANNER THAT UNREGULATED BUSINESS RECOVERS ITS COSTS. THE AUTHOR SUGGESTS MODERNIZING THE PRESENT DEPRECIATION PROCEDURES.

01662. IMPACT OF DESALINATION ON THE WATER ECONOMY.

WOLMAN, A.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 53(2), 1961, 119-124.

THE AUTHOR SAYS THAT AT THE PRESENT TIME, DESALINATION OF SEA WATER CANNOT ECONOMICALLY CHALLENGE FRESH-WATER SUPPLIES. SALINE WATER CONVERSION PROCESSES A TOO EXPENSIVE. MORE RESEARCH IN THE PHYSICAL CHEMISTRY OF HIGHLY MINERALIZED WATER AND DEVELOPMENT IN ENGINEERING DESIGN ARE REQUIRED TO BRING DESALINATION INTO COMPETION WITH FRESH WATER SOURCES.

01663. EFFECTS OF STIMULATION ON WELL OPERATING COSTS AND ITS PERFORMANCE ON OLD AND NEW WELLS.

KOENIG, L.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 52(12), 1960, 1499-1512.

IT WAS DECIDED, AS A RESULT OF A NATIONWIDE SURVEY OF WATER WELL STIMULATION PRACTICE, TO INVESTIGATE THE SAVINGS IN OPERATING COSTS EFFECTED BY STIMULATION TREATMENT, AS WELL AS TO DETERMINE WHETHER THE AGE OF THE WELL HAS ANY APPRECIABLE EFFECT ON THE TECHNICAL AND ECONOMIC PERFORMANCE OF STIMULATION. THIS ARTICLE SETS FORTH THE CRITERIA USED IN BOTH THESE INVESTIGATIONS AND THE CONCLUSIONS REACHED.

01664. RATES, REVENUES, AND RISING COSTS.

HOWSON, L.R.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 48(5), 1956, 465-471.

THE ALLOCATING OF REVENUE REQUIREMENTS EQUITABLY TO ALL CLASSES OF WATER CONSUMERS IS DISCUSSED. CHANGING REVENUE REQUIREMENTS, AND THE INCREASE IN OPERATION AND MAINTENANCE COSTS, FROM 1945 TO 1954 ARE BRIEFLY CONSIDERED.

01665. DETERMINATION OF STREAM USE.

BAXTER, S.S.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 56(10), 1964, 1285-1289.

THE PRACTICE OF ALLOCATING DIFFERENT USES TO DIFFERENT STREAMS, OR TO DIFFERENT REACHES OF THE SAME STREAM, IS DISCUSSED. UNDER THIS PLAN, EACH USE IS BALANCED AGAINST THE COSTS NECESSARY TO OBTAIN IT.

01666. USE OF PEAK DEMANDS IN DETERMINATION OF RESIDENTIAL RATES.

LINAWEAVER, F.P. JR.; GEYER, J.C.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 56(4), 1964, 403-410.

THE ALLOCATION OF PLANT INVESTMENT FOR RESIDENTIAL CUSTOMERS ACCORDING TO THEIR DOMESTIC AND SPRINKLING USES IS DISCUSSED. DATA ON RESIDENTIAL DEMANDS ARE PRESENTED TO ILLUSTRATE THE PRINCIPLES INVOLVED, AND VARIOUS ALTERNATIVES FOR DEVELOPING EQUITABLE WATER RATE SCHEDULES ARE OUTLINED.

01667. ECONOMIC ASPECTS OF WATER WELL STIMULATION.

KOENIG, L.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 52(5), 1960, 631-637.

THE ARTICLE DISCUSSES THE ECONOMIC DESIRABILITY OF WATER WELL STIMULATION. VARIOUS ECONOMIC CRITERIA WERE APPLIED TO THE RESULTS OF A NATIONWIDE SURVEY. SUCH ASPECTS AS COST OF STIMULATION, INVESTMENT COST COMPARISONS, STANDARD-WELL COSTS, AND UNIT COST RATIOS ARE CONSIDERED.

01668. A METHOD FOR CALCULATING POWER AND MUNICIPAL WATER RATES FOR PAYOUT STUDIES.

BARBOUR, E.; WILLAR, D.G.
U.S. DEPARTMENT OF INTERIOR, BUREAU OF RECLAMATION, DENVER, COLORADO, MARCH 1963, 21 P.

PAYOUT STUDIES DEMONSTRATE REPAYMENT OF PROJECT COSTS OVER CERTAIN PERIODS OF TIME AND AT INTEREST RATES ESTABLISHED BY CURRENT POLICY AND LEGISLATION. THE METHOD OF PREPARATION OF A PAYOUT STUDY PRESENTED IN THIS PAPER USES COMPOUND INTEREST AND ANNUITY TABLES TO PREDICT REQUIRED RATES WITHIN AN ACCURACY OF APPROXIMATELY ONE-HUNDREDTH OF A MILL PER KILOWATT HOUR OF POWER OR ONE HUNDREDTH OF A CENT PER THOUSAND GALLONS OF WATER. THIS METHOD SAVES CONSIDERABLE EFFORT OVER THE CUT-AND-TRY APPROACH OF MAKING OUT SEVERAL COMPLETE PAYOUT SCHEDULES IN ORDER TO FIND THE CORRECT RATE.

COST ANALYSIS OF WATER POLLUTION CONTROL

01669. ADEQUATE RATES AND REVENUES--KEY TO WATER WORKS FINANCING.

COHN, M.M.
WATER WORKS ENGINEERING, 111(4), 1958, 323-327, 399.

THE KEY TO IMPROVED AND ADEQUATE WATER SERVICE, THE AUTHOR SAYS, CAN BE FOUND ONLY IN ADEQUATE REVENUES TO MEET CURRENT OPERATIONS AND TO FINANCE BETTERMENTS. RATES MUST BE BASED ON REALISTIC RATE STRUCTURES WHICH CONSUMERS WILL WILLINGLY PAY. THIS ARTICLE PRESENTS A NATIONAL SAMPLING SURVEY OF RATES, REVENUE, AND FINANCING PRACTICES AND DISCUSSES THESE SUBJECTS.

01670. FACTORS AFFECTING STORAGE COSTS.

SIMPSON, R.W.
WATER WORKS ENGINEERING, 112(6), 1959, 519.

THE AUTHOR SAYS THAT ADEQUATE STORAGE, AT REASONABLE COST, HAS BECOME A KEY PART OF MOST WATER EXPANSION PROGRAMS. THE FOLLOWING METHODS AND THEIR COSTS ARE DISCUSSED: STORAGE OF RAW WATER IN EARTH DAMS, STORAGE OF TREATED WATER IN CONCRETE TANKS, AND STORAGE OF TREATED WATER IN STEEL TANKS.

01671. A REGIONAL WASTE DISPOSAL SYSTEM.

KNEESE, A.V.
WATER & SEWAGE WORKS, 110(4), 1963, 138-142.

THE AUTHOR PRESENTS ECONOMIC CRITERIA FOR THE DESIGN OF REGIONAL WASTE DISPOSAL SYSTEMS. POLLUTION GIVES RISE TO SOCIAL COSTS WHICH ARE NOT REFLECTED IN PRIVATE CALCULATIONS AND POINT IN A GENERAL WAY TO THE IMPLICATION THIS HAS FOR THE BEST ALLOCATION OF SOCIETY'S RESOURCES.

01672. WATER SERVICE AND WHAT IT COSTS, PART 3--COMPLETELY ADEQUATE TREATMENT FACILITIES.

ALDRICH, E.H.
WATER & SEWAGE WORKS, 102(7), 1955, 252-255.

THE AUTHOR DESCRIBES WHAT CONSTITUTES THE PROCESSING ELEMENTS IN A NORMAL WATER TREATMENT PLANT. THE PHYSICAL REQUISITES OF CAPACITY AND DEPENDABILITY NECESSARY IN AN ADEQUATE FACILITY ARE DISCUSSED. THE WATER SOURCE DETERMINES WHAT TYPE OF TREATMENT IS NEEDED. OPERATING COSTS OF SOME REPRESENTATIVE COMPANIES ARE LISTED.

01673. WATER SERVICE AND WHAT IT COSTS, PART 4--A COMPLETELY ADEQUATE DISTRIBUTION SYSTEM.

VEATCH, N.T.
WATER & SEWAGE WORKS, 102(8), 1955, 279-283.

THE AUTHOR DISCUSSES THE MAJOR PROBLEMS INVOLVED IN PLANNING, FINANCING, CONSTRUCTING, AND OPERATING A WATER DISTRIBUTION SYSTEM. THE DISTRIBUTION SYSTEM REPRESENTS ALMOST TWO-THIRDS OF THE INVESTMENT IN THE WATER WORKS PLANT OF THE AVERAGE COMMUNITY. IT IS STATED THAT ADEQUATE AND SATISFACTORY FLOW TO THE CUSTOMER IS THE MAJOR REQUIREMENT OF THE MAINS IN THE SYSTEM.

01674. WATER PURIFICATION BY ZONE-FREEZING.

MINK, W.H.; SACHSEL, G.F.; FILBERT, R.B. JR.
SALINE WATER CONVERSION, ADVANCES IN CHEMISTRY SERIES 27, AMERICAN CHEMICAL SOCIETY, WASHINGTON, D.C., 1960, 75-81.

THE ECONOMICS OF PURIFICATION OF SALINE WATER BY ZONE-FREEZING WAS INVESTIGATED USING ANALOG SIMULATION AS A TOOL TO OPTIMIZE THE DESIGN. ESTIMATED COSTS FOR THE PROCESS WERE FOUND TO BE TOO HIGH TO MAKE IT COMPETITIVE WITH OTHER PROCESSES THEN UNDER DEVELOPMENT.

01675. THE VALUE OF WATER IN ALTERNATIVE USES, WITH SPECIAL APPLICATION TO WATER USE IN THE SAN JUAN AND RIO GRANDE BASINS OF NEW MEXICO.

WOLLMAN, N.
THE UNIVERSITY OF NEW MEXICO PRESS, ALBUQUERQUE, NEW MEXICO, 1962, 426 P.

THE STUDY WAS UNDERTAKEN TO DETERMINE THE ECONOMIC EFFECTS OF DIFFERENT PATTERNS OF WATER USE. THE STUDY WAS DIVIDED INTO THREE MAJOR AREAS: AGRICULTURE, MUNICIPAL, AND INDUSTRIAL USES, AND MINING. THE USE OF WATER FOR RECREATION IS ALSO DISCUSSED.

01676. CHOOSING AMONG ALTERNATIVE PUBLIC INVESTMENTS IN THE WATER RESOURCES FIELD.

STEINER, P.O.
AMERICAN ECONOMIC REVIEW, 49(5), DECEMBER 1959, 893-916.

THE AUTHOR SAYS THAT QUESTIONS INVOLVING THE AMOUNT AND FORM OF PUBLIC INVESTMENTS REQUIRE CRITERIA FOR EVALUATING THE INVESTMENTS AND OPERATIONAL GUIDES FOR APPLYING THE CRITERIA. IN THIS PAPER, THE AUTHOR FOCUSES ATTENTION ON THE PROBLEM OF CHOOSING AMONG ALTERNATIVE PUBLIC EXPENDITURES WITH PARTICULAR REFERENCE TO WATER RESOURCE DEVELOPMENT.

01677. ECONOMIC EVALUATION OF WATER.

MCGAUHEY, P.H.; ERLICH, H.
JOURNAL OF THE IRRIGATION AND DRAINAGE DIVISION, PROCEEDINGS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, 85(IR2), JUNE 1959, 1-21.

THE AUTHORS DESCRIBE THE DOMINANT FORCE IN DEVELOPING WATER RESOURCES IN THE WEST AS HAVING BEEN LAND IRRIGATION, PRESUPPOSING THAT THE MAXIMUM ECONOMIC BENEFIT WOULD RESULT FROM THE MAXIMUM OCCUPANCY OF LAND BY PEOPLE. THE RISE OF INDUSTRY AS A MAJOR FACTOR IN WESTERN ECONOMY HAS RENDERED THIS CRITERION INADEQUATE. A BROADER POLICY BASIS IS NEEDED BY WHICH PRESENTLY UNAPPROPRIATED WATER IS ALLOCATED TO VARIOUS BENEFICIAL USES TO PRODUCE THE GREATEST ECONOMIC YIELD. THE HISTORICAL DEVELOPMENT OF WATER RIGHTS AND WATER VALUE ARE DESCRIBED AND FACTORS WHICH TEND TO PERPETUATE TRADITIONAL CONCEPTS ARE DISCUSSED. CONSIDERED ARE FINANCIAL FACTORS, LAND CLASSIFICATION, LEGAL FACTORS, AND POLITICAL FACTORS. ALSO DISCUSSED ARE ECONOMIC IMPLICATIONS INCLUDING PERSONAL INCOME, MANUFACTURING, AND ECONOMIC VALUES RESULTING FROM

UTILIZING A GIVEN AMOUNT OF WATER ON LAND AND IN MANUFACTURING.

01678. OUTLOOK FOR ECONOMIC USE OF FRESH WATER FROM THE SEA.

MORRIS, S.B.
JOURNAL OF THE IRRIGATION AND DRAINAGE DIVISION, PROCEEDINGS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, 87(IR2), PART 1, JUNE 1961, 15-26.

THIS PAPER CONSIDERS THE COSTS OF NORMAL WATER SUPPLIES IN COMPARISON TO PRESENT AND ANTICIPATED FUTURE COSTS OF PRODUCING FRESH WATER FROM THE SEA AND FROM SALINE WATERS. THIS COST COMPARISON IS THEN RELATED TO THE POSSIBLE WATER REQUIREMENTS OF THE CONTINENTAL UNITED STATES.

01679. WATER FROM THE SEA.

WOOD, N.
PUBLIC WORKS, 93(7), 1962, 86-87.

THE OPERATION OF THE ONE MILLION GALLON-PER-DAY SALINE WATER CONVERSION PLANT AT POINT LOMA, SAN DIEGO, CALIFORNIA, IS DISCUSSED, AND THE MULTIPLE FLASH DISTILLATION PROCESS USED BY THE PLANT IS BRIEFLY DESCRIBED. PLANT DESIGN DATA AND COST DATA ARE ALSO INCLUDED.

01680. GOVERNMENTAL REGULATIONS AND THE COST OF SEWAGE TREATMENT.

HALVERSON, H.O.
PUBLIC WORKS, 92(3), 1961, 126-127.

A REGULATION ADOPTED BY THE CENTRAL STATES REDUCING THE PERMISSIBLE LOADING ON TRICKLING FILTERS FOR SEWAGE TREATMENT IS DISCUSSED. THE AUTHOR STATES THAT THE RESTRICTIONS ARE UNJUSTIFIED AND WILL INCREASE THE COST OF CONSTRUCTION OF TRICKLING FILTERS WITHOUT COMPENSATING BENEFIT. HE BRIEFLY DISCUSSES A NUMBER OF FACTORS WHICH CAN LEAD TO INSUFFICIENT AERATION AND HENCE DISAGREEABLE ODORS.

01681. DESALINATION BRINE WASTE DISPOSAL.

VIESSMAN, W. JR.
PUBLIC WORKS, 94(12), 1963, 117-118.

THIS ARTICLE BRIEFLY DISCUSSES THE MAGNITUDE OF THE PROBLEM OF DISPOSING OF THE BRINE WASTES ASSOCIATED WITH SALINE WATER CONVERSION. THE RELATIVE SIZE OF THE WASTE DISPOSAL OPERATION IS ILLUSTRATED BY COMPARING THE WASTES PRODUCED BY A COMPLETE SEWAGE TREATMENT FACILITY WITH THOSE DERIVED FROM A DESALINATION PLANT. SOME POSSIBLE PROCESSES FOR HANDLING THE DESALINATION BRINE WASTES ARE SUMMARIZED.

01682. EFFECT OF INFLATION ON WATER RATES.

MACDONALD, C.D.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 47(7), 1955, 657-659.

THE MAJOR ELEMENTS THAT AFFECT WATER RATES ARE PRESENTED; OF THESE INFLATIONIS DISCUSSED AS BEING THE PRINCIPAL CAUSE OF INCREASED WATER RATES.

01683. A STATISTICAL ANALYSIS OF WATER WORKS DATA FOR 1955.

SEIDEL, H.F.; BAUMANN, R.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 49(12), 1957, 1531-1566.

THE DATA PRESENTED IN A MAY 1957 PUBLICATION BY THE JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION, 'A SURVEY OF OPERATING DATA FOR WATER WORKS IN 1955, ' ARE SUBJECTED IN THIS ARTICLE TC STATISTICAL ANALYSIS WITH RESPECT TO TWO BROAD AREAS OF INTEREST. THE FIRST INVOLVES THE PRESENCE (OR ABSENCE) OF GENERAL TRENDS. THE SECOND AREA OF INTEREST IS THE POSSIBILITY OF DETERMINING NORMS FOR VARIOUS ASPECTS OF WATER WORKS OPERATIONS, SO THAT THE MANAGEMENT OF A PARTICULAR UTILITY CAN JUDGE HOW IT COMPARES WITH OTHER UTILITIES OPERATING UNDER SIMILAR CONDITIONS.

01684. ECONOMIC IMPLICATIONS OF INDUSTRIAL WASTE CONTROL.

CLEARY, E.J.
PUBLIC WORKS, 94(2), 1963, PP. 64, 66, 68.

THE AUTHOR DISCUSSES SOME OF THE ECONOMIC IMPLICATIONS OF POLLUTION CONTROL. AN APPRAISAL IS MADE OF INDUSTRY'S STAKE IN THE CONDUCT OF WATER POLLUTION CONTROL. THE ARTICLE EXAMINES SOME INFORMATION ON WHOT INDUSTRY STANDS TO LOSE IN USING DEGRADED WATER.

01685. MUNICIPAL SEWER SERVICE CHARGES.

AMERICAN CITY, BUTTENHEIM PUBLISHING CORPORATION, NEW YORK, N.Y., 1965, 108 P.

THE FUNDAMENTALS THAT REQUIRE CONSIDERATION WHEN A MUNICIPALITY ADOPTS A SYSTEM OF CHARGES FOR THE USE OF ITS SEWER SYSTEM AND PURIFICATION-PLANT FACILITIES ARE ANALYZED. A SERIES OF SEWER-SERVICE CHARGES IN SELECTED AREAS THROUGHOUT THE UNITED STATES IS PRESENTED, AND A REVIEW OF METHODS USED IN PROVIDING SEWERAGE SERVICE TO A GROUP OF CITIES WITHIN A METROPOLITAN REGION IS ALSO INCLUDED. A STUDY IS DESCRIBED THAT SHOWS HOW CITIES CAN DESIGN AND OPERATE THEIR SEWAGE PURIFICATION PLANTS SO THAT THEY ARE NOT SIMPLY UTILITARIAN STRUCTURES PERFORMING A NECESSARY TASK.

01686. ADVANCED TREATMENT OF WASTE WATERS FOR REUSE.

WATER AND SEWAGE WORKS, 3(9), 1964. 401-410.

SOME EXAMPLES OF WASTE WATER REUSE AND THE NEED FOR ADVANCED WASTE TREATMENT PROCESSES ARE BRIEFLY DISCUSSED. THE STATUS OF ADVANCED WASTE TREATMENT PROCESSES IS REVIEWED BY BRIEFLY PRESENTING NINE PROCESS DESCRIPTIONS WHICH REPRESENT PROGRESS REPORTS ON THE STATUS OF STUDIES IN THIS AREA. NO FIRM COST FIGURES FOR THESE PROCESSES COULD BE GIVEN; HOWEVER, ESTIMATED COSTS BASED ON PROJECTIONS OF DATA AT HAND ARE MADE.

01687. CAN WATER BE ALLOCATED BY COMPETITIVE PRICES.

MCPHERSON, W.K.
JOURNAL OF FARM ECONOMICS, 38(5), DECEMBER 1956, 1259-1268.

A CONCEPTUAL FRAMEWORK FOR EVALUATING THE ECONOMIC STATUS OF WATER IS DISCUSSED, AND AN ECONOMIC ENVIRONMENT THAT WOULD FACILITATE THE COMPETITIVE PRICING OF FACILITIES THAT MAKE WATER USEFUL IS DESCRIBED. ALSO, THE EXTENT TO WHICH IT MAY BE POSSIBLE TO USE COMPETITIVE PRICES TO ALLOCATE THE COST OF WATER-PRODUCING FACILITIES IS DISCUSSED..

01688. ECONOMICS OF LEAK SURVEYS.

BECKWITH, H.E.
JOURNAL AMERICAN WATER WORKS ASSOCIATION, 56(5), 1964, 575-578.

THE DIVIDENDS TO BE DERIVED BY REDUCING WATER LOSS DUE TO LEAKAGE ARE DISCUSSED IN TERMS OF DOLLAR SAVINGS AND PLANT CAPACITY REDUCTION.

01689. ELECTRODIALYSIS COSTS.

BARNHILL, K.G.
WATER AND SEWAGE WORKS, 109(3), 1962, 87-90.

THIS PAPER PRESENTS THE INVESTMENT AND OPERATING COSTS RELATING TO THE ELECTTRODIALYSIS PROCESS FOR SEVERAL BRACKISH WATERS, PLANT SIZES, AND TEMPERATURES. THE OPERATING COSTS ARE BROKEN DOWN INTO THEIR INDIVIDUAL COMPONENTS, AND THE COSTS OF OTHER METHODS ARE TOUCHED ON BRIEFLY.

01690. WELFARE ECONOMICS AND RESOURCE DEVELOPMENT, IN LAND AND WATER: PLANNING FOR ECONOMIC GROWTH. 1961 WESTERN RESOURCES CONFERENCE.

GARNSEY, M.E.
UNIVERSITY OF COLORADO PRESS, BOULDER, COLORADO, 1962, 191-204.

THE AUTHOR PRESENTS A CRITICAL ANALYSIS OF FOUR BOOKS: WATER-RESOURCE DEVELOPMENT BY O. ECKSTEIN; MULTIPLE PURPOSE RIVER DEVELOPMENT BY J. KRUTILLA AND O. ECKSTEIN; EFFICIENCY IN GOVERNMENT THROUGH SYSTEMS ANALYSIS, WITH PARTICULAR REFERENCE TO WATER RESOURCE DEVELOPMENT BY ROLAND MCKEAN; AND WATER SUPPLY: ECONOMICS, TECHNOLOGY, AND POLICY BY J. HIRSHLEIFER, J. C. DEHAVEN, AND J. W. MILLIMAN.

01691. OUTDOOR RECREATION: A BIBLIOGRAPHY.

ROSENTHAL, E.P.
JOURNAL OF SOIL AND WATER CONSERVATION, 18(2), MARCH-APRIL 1963, 73-76.

THE INTER-RELATIONSHIP BETWEEN EFFORTS TO PRESERVE, ENHANCE, AND DEVELOP NATURAL RESOURCES FOR OUTDOOR RECREATION AND BASIC SOIL AND WATER CONSERVATION PRINCIPLES AND CONCEPTS IS REFLECTED IN THE BOOKS AND PAMPHLETS LISTED IN THIS PARTIAL BIBLIOGRAPHY OF OUTDOOR RECREATION. MATERIALS PUBLISHED IN THE THREE YEARS PRIOR TO THE COMPILATION OF THE BIBLIOGRAPHY ARE INCLUDED.

01692. THE ROLE OF UNCERTAINTIES IN THE ECONOMIC EVALUATION OF WATER-RESOURCES PROJECTS.

ALTOUNEY, E.G.
INSTITUTE OF ENGINEERING-ECONOMIC SYSTEMS, REPORT EEP-7, STANFORD UNIVERSITY, STANFORD, CALIFORNIA, AUGUST 1963, 115 P.

THIS STUDY ASSESSES THE RELIABILITY OF THE VALUES OF NEW BENEFITS AND THE BENEFIT-COST RATIO PRESENTED TO DECISIONMAKERS AS CRITERIA FOR DECISION WHEN BOTH THE PRELIMINARY COST AND BENEFIT ESTIMATES ARE SUBJECT TO LARGE ERRORS. A METHOD BY WHICH THE UNCERTAINTY OF THE BENEFIT-COST ANALYSIS CAN BE QUANTIFIED IS DEMONSTRATED.

01693. WATER POLLUTION CONTROL AND ITS CHALLENGE TO POLITICAL ECONOMIC RESEARCH, PROCEEDINGS OF THE NATIONAL CONFERENCE ON WATER POLLUTION, DECEMBER 12-14, 1960.

BRANDT, K.
U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, PHS PUBLICATION NO. 819, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C., 1961, 474-488.

THE AUTHOR ANTICIPATES THE NEED FOR A CONSIDERABLE ALLOCATION OF RESEARCH RESOURCES TO ECONOMIC AND LEGAL PROBLEMS RELATING TO WATER AND TO PROBLEMS ARISING FROM THE NECESSITY TO ABATE WATER POLLUTION. THE GREATEST CHALLENGE LIES IN THE OPPORTUNITY OF CONTRIBUTING TO A BETTER UNDERSTANDING OF ALTERNATIVE ARRANGEMENTS TO ATTAIN THE DESIRED ENDS OF OPTIMUM POLLUTION ABATEMENT WITH A MINIMUM OF COSTS AND A MINIMUM OF DISTORTION OF OUR ECONOMIC SYSTEMS.

01694. WATER RESOURCES RESEARCH CATALOG. VOL. 1, PART 1: FEDERALLY SUPPORTED RESEARCH IN PROGRESS.

OFFICE OF WATER RESOURCES RESEARCH, U.S. DEPARTMENT OF THE INTERIOR.
U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C., FEBRUARY 1965, 441 P.

MATERIAL COVERED IN THIS CATALOG WAS DRAWN FROM RESEARCH RECORDS IN THE SCIENCE INFORMATION EXCHANGE ACTIVE AS OF NOVEMBER 1964 AS WELL AS OTHERS SUBMITTED BY GOVERNMENT AGENCIES FOR INCLUSION. PROJECTS LISTED WERE REVIEWED AND APPROVED AS WATER RESOURCES RESEARCH BY THE FEDERAL AGENCIES THAT SUPPORT THEM. CATEGORIES INCLUDE: NATURE OF WATER, WATER CYCLE, WATER AND LAND MANAGEMENT, DEVELOPMENT AND CONTROL, QUALITATIVE ASPECTS, REUSE AND SEPARATION, ECONOMIC AND INSTITUTIONAL ASPECTS, ENGINEERING WORKS, AND MANPOWER AND RESEARCH FACILITIES.

01695. ILLINOIS STATE WATER SURVEY: WATER TRANSMISSION COSTS.

ACKERMAN, W.C.
ILLINOIS DEPT OF NATURAL RESOURCES AND CONSERVATION, OCT. 1967. (PB-185 860.

01696. ILLINOIS STATE WATER SURVEY: COST OF WATER TREATMENT IN ILLINOIS.

ACKERMAN, W.C.
ILLINOIS DEPT OF NATURAL RESOURCES AND CONSERVATION, OCT. 1968. (PB-185 856.

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01697. ILLINOIS STATE WATER SURVEY: COST OF MUNICIPAL SEWAGE TREATMENT.

ACKERMAN, W.C.
ILLINOIS DEPT OF NATURAL RESOURCES AND CONSERVATION, JUNE 1969.

01698. WATER QUALITY MANAGEMENT METHODOLOGY AND ITS APPLICATION TO THE SAINT JOHN RIVER.

H.G. ACRES LIMITED, NIAGARA FALLS, ONTARIO, P 1-76, AUG. 1971.

01699. WATER QUALITY MODELS.

H.G. ACRES LIMITED, NIAGARA FALLS, ONTARIO, P 1-53, AUG. 1971.

01700. A MATHEMATICAL MODEL FOR WASTE STABILIZATION POND.

ADVANCED WASTE TREATMENT RESEARCH LAB., CINCINNATI, OHIO, 1969.

01701. COST ESTIMATING COMPUTER PROGRAM FOR WASTEWATER TREATMENT PLANTS.

ADVANCED WASTE TREATMENT RESEARCH LAB., CINCINNATI, OHIO, 1970.

01702. BASIN MANAGEMENT FOR WATER REUSE.

ALAMO AREA COUNCIL OF GOVERNMENTS.
DIVISION OF RESEARCH AND MONITORING, EPA, FEB. 1972.

01703. TREATMENT-COST RELATIONSHIPS FOR INDUSTRIAL WASTE TREATMENT.

BARNARD, J.L.; WESLEY, W.; ECKENFELDER, JR.
TECHNICAL REPORT NO 23, ENVIRONMENTAL AND WATER RESOURCES ENGINEERING, VANDERBILT U., 1971. (BARNARD'S PH.D. THESIS UNDER SAME TITLE, VANDERBILT U., 1971..

01704. THE IMPACT OF MINE DRAINAGE POLLUTION ON INDUSTRIAL WATER USES IN APPALACHIA.

BATTELLE, MEMORIAL INSTITUTE, COLUMBUS, OHIO.
REPORT TO APPALACHIAN REGIONAL COMMISSION.

01705. OPTIMAL WASTE TREATMENT PLANT DESIGN UNDER UNCERTAINTY.

BERTHOUEX, P.M.
THE U OF WISCONSIN, PH.D. THESIS, 1970.

01706. DIVERGENCE OF PRIVATE AND SOCIAL BENEFIT COST.

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AN ELEMENTARY EXPOSITION OF CHOICE CRITERIA FOR SOCIAL INVESTMENT IS PRESENTED. THE TWO CAUSES FOR DISCOUNTING THE FUTURE BENEFITS, TIME PREFERENCE AND OPPORTUNITY COST, ARE DISCUSSED. A CLEAR AND SIMPLE DEFINITION OF PRESENT VALUE IS VALUE. THE GENERAL REASONS FOR SPECIAL METHODS OF MEASURING BENEFITS ARE ALSO DISCUSSED. THE SUBSEQUENT DISCUSSION IS A MORE DETAILED ANALYSIS OF THE APPLICATION OF THESE PRINCIPLES, TOGETHER WITH SOME REMARKS ON THE MEASUREMENT OF COSTS. GOOD DISCUSSIONS OF THE BEST INTEREST RATE ARE ALSO INCLUDED.

01828. ON THE MARGINAL COST PRICING OF MUNICIPAL WATER.

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IT HAS BEEN MAINTAINED THAT MUNICIPAL WATER SUPPLY SHOULD BE PRICED SO THAT MARGINAL COST EQUALS PRICE. BUT THERE ARE LIKELY TO BE THIRD PARTY BENEFITS FROM SOME COMPONENTS OF MUNICIPAL WATER USE. MARGINAL COST PRICING MAY RESULT IN A PRICE THAT EXCEEDS A SOCIALLY OPTIMUM PRICE.

01829. ECONOMIC EFFICIENCY OF WATER QUALITY STANDARDS OR CHARGES.

BROWN, G.; MAR, B.
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THERE EXIST CONDITIONS UNDER WHICH IT MAY BE DYNAMICALLY MORE EFFICIENT TO ESTABLISH PRESENT WATER QUALITY LEVELS THAT WILL BE OPTIMUM ONLY AT SOME FUTURE DATE. EXCESS DEMAND FUNCTIONS AND AN AGGREGATE NONLINEAR DAMAGE FUNCTION ARE THE CONCEPTUAL UNDERPINNINGS OF THIS PAPER.

01830. WATER POLICY AND ECONOMIC OPTIMIZING: SOME CONCEPTUAL PROBLEMS IN WATER RESEARCH.

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AN EMPIRICAL ANALYSIS OF THE EFFECTS ON RESIDUAL WATER USE FROM A FLAT RATE PRICE STRUCTURE TO A METERED ONE IS PRESENTED. TIME SERIES DATA, FOR THE FIRST TIME, ARE USED TO STUDY THE DYNAMICS OF RESIDUAL WATER DEMAND. THE RESULTS INCLUDE THE OBSERVATIONS THAT: (1) SPRINKLING DEMANDS WERE REDUCED BY THE INTRODUCTION OF METERS, WITH ACTUAL SPRINKLING BEING GREATER THAN THE CALCULATED IDEAL UNDER FLAT RATES AND LESS THAN IDEAL UNDER METERED RATES; (2) SPRINKLING USE NOT ONLY DECLINED WITH THE INTRODUCTION OF METERS BUT SUB-

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SEQUENTLY CONTINUED TO DECLINE, (3) DOMESTIC DEMANDS (INuHOUSE) WERE REDUCED BY 36 PER CENT AFTER METER INSTALLATION, AND (4) DOMESTIC DEMANDS STABILIZED AT THESE LOWER LEVELS. THE EVIDENCE GENERATED BY THE ANALYSIS DEMONSTRATES THAT WATER USERS DO NOT RETURN TO THEIR OLD USE PATTERNS AFTER METERS ARE INSTALLED, AND THAT METERING RESULTS IN A PERMANENT AND SIGNIFICANT IMPROVEMENT IN WATER USE EFFICIENCY.

01835. WATER RESOURCE INVESTMENT AND THE PUBLIC INTEREST.

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SEVERAL METHODS OF ALLOCATING WASTE REDUCTIONS AMONG DISCHARGES ARE AVAILABLE TO WATER POLLUTION CONTROL ADMINISTRATORS. THE MOST RECENT IS THE EFFLUENT CHARGE. COMPARISONS ARE MADE BETWEEN TWO SUCH SCHEMES. THE RESULTS INDICATE THAT THE EFFLUENT CHARGE CONCEPT SHOULD BE SERIOUSLY CONSIDERED AS A MEANS OF ATTAINING WATER QUALITY IMPROVEMENT AT LESSER COST THAN OTHER CONVENTIONAL SCHEMES.

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KIMBALL, T.L.
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INVESTMENT PROGRAMMING FOR MULTIPLE OBJECTIVES HAS BECOME AN IMPORTANT NEW ELEMENT IN WATER RESOURCES PLANNING. REFERENCE IS MADE TO CURRENT MULTIPLE OBJECTIVE PLANNING EFFORTS AND THE BENEFIT-COST RATIO APPROPRIATE TO SUCH PROJECTS IS PRESENTED. IT IS SHOWN HOW THIS RATIO DIFFERS FROM THE RATIO REQUIRED BY CURRENT FEDERAL INSTRUCTIONS, WHICH DO NOT ALLOW AGENCIES TO REFLECT ACCURATELY THE INTERACTION OF SOCIAL PREFERENCES AND INVESTMENT OPPORTUNITIES. A CHANGE IN THE FEDERAL INSTRUCTIONS IS RECOMMENDED.

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THE PURPOSE OF THIS PAPER IS TO PRESENT ONE INTERDISCIPLINARY TECHNIQUE WHICH WILL SUPPLY EMPIRICAL MEASURES OF EXTERNAL EFFECTS IN WATER RESOURCES AND THEIR RELATION TO GROUP ACTION AND MANAGEMENT. IT COMPARES COSTS OF CONTROLLING PULP POLLUTION IN A SMALL AREA WITH BENEFITS ARISING FROM ALTERNATIVE CONTROL METHODS. IT ALSO MEASURES THESE BENEFITS AND INDIRECT EFFECTS BY MEANS OF LOCAL INPUT-OUTPUT ANALYSIS.

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WATSON, K.S.
WATER POLLUTION CONTROL FEDERATION JOURNAL, 42(1), FEBRUARY 1970, 209-217.

THIS PAPER POINTS OUT THE ADVANTAGES OF JOINT TREATMENT, ECONOMIC ADVANTAGES AND QUALITY OF MANAGEMENT. PROCEDURES FOLLOWED IN PLANNING THE REGIONAL APPROACH ARE DISCUSSED.

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A PORTION OF A RADIO INTERVIEW WITH A CERTAIN DR. PANGLOSS IS PRESENTED AFTER WHICH THE AUTHOR CRITICIZES THE VIEWS PUT FORTH BY DR. PANGLOSS CONCERNING ENVIRONMENTAL DETERIORATION. DR. PANGLOSS MAINTAINS THAT POLLUTION IS NOT A SERIOUS PROBLEM BUT IS RATHER, IN THE MAIN, AN ATTEMPT BY SCIENTISTS AND MEN OF AFFAIRS TRYING TO FOIST THEIR OWN TASTES AND SYSTEMS OF VALUES ONTO THE REST OF SOCIETY, AND THAT THE PEOPLE WOULD BE SERVED BETTER IF GOVERNMENT INTERVENTION WERE LESS. HE MAINTAINS THAT OPTIMALITY IS UNIQUELY DETERMINED REGARDLESS OF LEGAL OR DISTRIBUTIONAL CONSIDERATIONS AND THAT POLLUTION ABOVE A CERTAIN OPTIMUM CAN BE ECONOMICAL JUST IN SO FAR AS THE HEAVY TRANSACTION COSTS OF CORRECTING THE EXISTING SUBOPTIMAL POSITION ARE REAL COSTS AND EXCEED THE OPTIMALITY GAINS. MISHAN ARGUES, HOWEVER, THAT CHANGING TO ANTI-POLLUTION LAWS ALTERS THE OPTIMAL POSITION AS WELL AS REVERSING THE ROLE OF THE TRANSACTIONS-COST BARRIER, THE EFFECT BEING 'TOO LITTLE' POLLUTION. SINCE TRANSACTIONS COSTS RESULT FROM ANY CHANGE TOWARD AN OPTIMUM POSITION, A CHANGE TO ANTI-POLLUTION LAWS MUST BE BASED ON EQUITY AND ALLOCATIVE EFFECTS, WITH EMPHASIS PLACED ON THE EXTERNAL ECONOMIES OF INCREASING RISK. MISHAN CONCLUDES THAT THERE APPEARS TO BE A PRIMA FACIE CASE IN EQUITY AGAINST THE POLLUTER AND ALSO THAT THERE CAN BE GROUNDS FOR GOVERNMENT CONTROLS.

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